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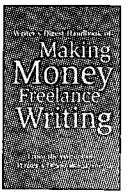

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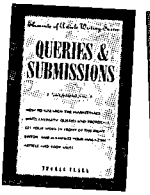

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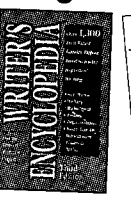

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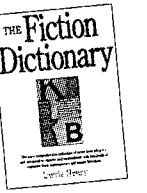

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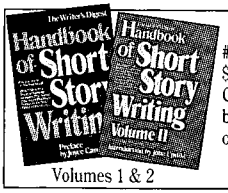

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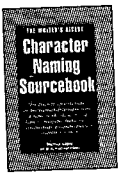

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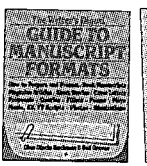

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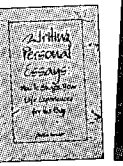

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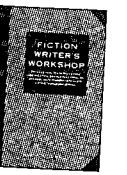

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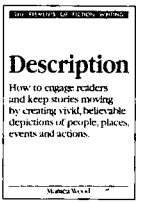
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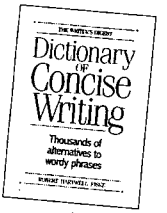

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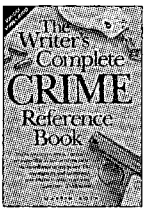

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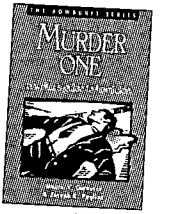

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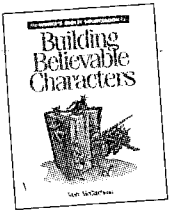

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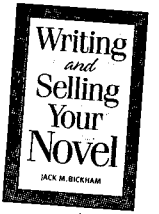

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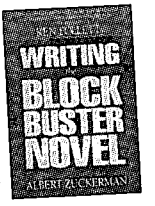

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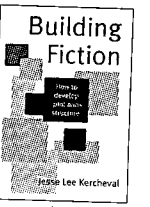

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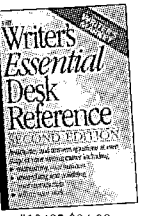

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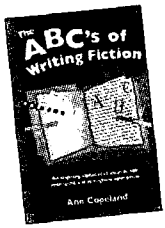

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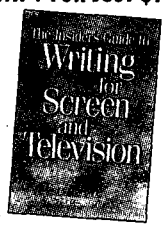

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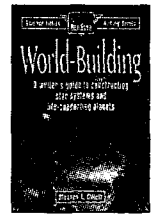

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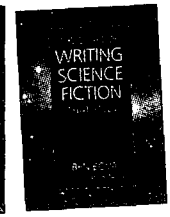

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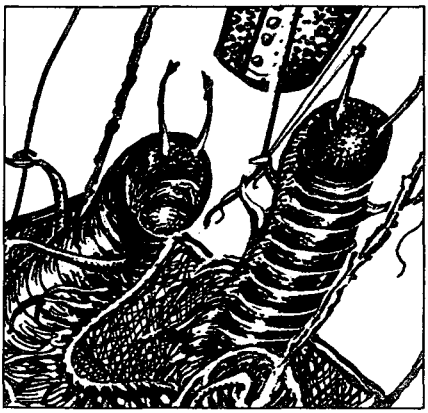

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EDITORIAL Stanley Schmidt

A DOUBLE CELEBRATION

This special issue marks two special occasions that happen to coincide: the seventieth anniversary of the founding of *Analog*, and the new millennium (the first of *those* to be experienced by anybody now alive!).

First, a few words about the "new millennium": please *put down that pen!* I'm well aware that people are divided on whether the millennium should be considered to start with January 2000 or January 2001, that a case can be made for either, and that many proponents of each refuse to acknowledge that the other could possibly have any merit at all. I've heard all the arguments for both, understand them thoroughly, and neither need nor want to read or hear them again.

It's remarkably unimportant anyway. A millennium is just a thousand years—*any* thousand years. Of course it's true, and indisputable, that if what you're talking about is the first thousand years A.D. (or C.E.), measured from that "zero" which is simply the instant separating the years rather arbitrarily called 1 B.C. and 1 A.D., then that won't be over until the end of the year called 2000. It's just as true that as the language is normally spoken, the "Twentieth Century" is almost universally understood to mean "those dates beginning with 19," i.e., 1900-1999; and in the same manner the "Second Millennium" is almost universally understood to mean "those four-digit dates beginning with 1," i.e., 1000-1999. Sure, that means there's one anomalous "millennium" that's one year short. That doesn't bother me any more than the fact that a "month" is commonly considered a unit of time but can have four different actual lengths. (And that's just in everyday usage, without getting into the various kinds of months used by astronomers and different religions!) If it bothers you, celebrate whenever you like. Personally, I plan to follow a reader's suggestion to cover all bases: start celebrating at the end of 1999, and continue through the beginning of 2001.

There is, of course, one thing that *is* special about the beginning of 2000: the headaches caused by shortsighted programming of computers (or, more precisely, shortsighted *management* of that programming). Obviously that special feature is purely a human artifact, because the calendar itself is a human artifact. The same thing would happen at *whatever* time your calendar was designed to roll over, if you started working with computers shortly before it and underestimated the extent to which you would still be using old records after the change. If we're lucky, the problems occurring on and after January 1 will be minimal; but even if they're negligible, nobody can reasonably claim that two-digit software dates caused no trouble. If we get off easy on New Year's Day, it will be not be because there was never any problem, but because vast numbers of dollars and person-hours were *already* spent trying to solve it before the deadline.

Analog's birthday is considerably less controversial than the beginning of the

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millennium. The record clearly shows that this magazine began its life with the January 1930 issue of *Astounding Stories of Super-Science*. It underwent several minor changes of title, and one major one, when in 1960 it metamorphosed over several months into *Analog Science Fact & Fiction* (which remains basically the title right up to the present, though that, too, has had a few minor variations). Through those seven decades, it has maintained an approximately monthly schedule with no interruptions except a few slight irregularities in 1932 and 1933—a record not closely approached by any other science fiction magazine.

Astounding/Analog is probably also unique in having had only five editors in seventy years: Harry Bates, who started it all; F. Orlin Tremaine; John W. Campbell, Jr.; Ben Bova; and Stanley Schmidt. All have been writers as well as editors, and Campbell is generally credited with having revolutionized the whole field of science fiction by demanding an equal and unprecedented degree of attention to both words in that term. Trained as a physicist and writing widely different kinds of stories under two of the most popular names in the business, as editor he shifted the emphasis from gadgets as gadgets to exploring the ways future scientific and technological developments might affect human life. That required careful attention to both scientific plausibility and character interaction, both of which have remained hallmarks of the magazine through its entire history—even when popular usage of the term "science fiction" has expanded to include many things having little to do with science. At *Analog*, when we say *science fiction*, we mean it—but that does *not* mean, as some people mistakenly believe, that we're more interested in machines than in people!

Another common misconception about science fiction is that its writers are trying to predict the future. That's seldom, if ever, true. The *first* thing we're trying to do is to tell a story that readers will enjoy reading. But we're also trying to imagine *possible* futures—not to say what *will* happen, but to explore a wide range of things that *might* happen. Indeed, one of the reasons John Campbell changed the name of the magazine from *Astounding* to *Analog* was that he thought of each story as a thought experiment, an analog simulation of a possible future. An author creates a possible world on paper, throws some characters into it, and we all watch what happens. That gives us a chance to explore the possible consequences some future development might have *before* we subject real people to it—which can help us decide which futures we'd like to strive for, and which we should work to avoid.

When you do that sort of thing—trying to imagine as many as possible of the options that lie ahead of us—it's inevitable that some will actually come to pass, in more or less recognizable form, while other "predictions" will be clear

Analog Science Fiction and Fact (Astounding) USPS 488-910 is published monthly except for a combined July/August double issue by Dell Magazines, a division of Crosstown Publications. One-year subscription for $39.97 in the U.S.A. and possessions, in all other countries, $47.97 (GST included in Canada, GST # 123054108) payable in advance in U.S. funds. First copy of new subscription will be mailed within eight weeks of receipt of order. When reporting change of address allow 6 to 8 weeks and give new address as well as the old address as it appears on the last label. Periodical postage paid at Norwalk, CT and additional mailing offices. Canadian postage paid at Montreal, Quebec. Canada Post International Publications Mail, Product Sales Agreement No. 260622. © 1999 by Dell Magazines, a division of Crosstown Publications, all rights reserved. Protection secured under the Universal Copyright Convention. Reproduction or use of editorial or pictorial content in any manner without express permission is prohibited. All stories in this magazine are fiction. No actual persons are designated by name or character. Any similarity is coincidental. All submissions must be accompanied by stamped self-addressed envelope, the publisher assumes no responsibility for unsolicited manuscripts or artwork. ISSN 1059-2113

POSTMASTER: Send change of address to: ANALOG SCIENCE FICTION AND FACT
P.O. Box 54625, Boulder, CO 80328-4625.

IN CANADA RETURN TO: Transcontinental Sub Dept, 525 Louis Pasteur, Boucherville, Quebec, J48 8E7
Executive Office: Penny Press, 6 Prowitt St., Norwalk, CT 06855
Editorial and Advertising: Analog Science Fiction and Fact, 475 Park Avenue South, New York, N.Y. 10016
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and wide misses. Such space exploration as we've seen, and will see, owes its reality largely to the fact that science fiction writers and readers saw the possibility long before the general public did, and some of them helped make it happen. Cleve Cartmill's story "Deadline," which John Campbell published here in World War II, described an atomic bomb so accurately that FBI agents showed up in the *Astounding* office, demanding to know where the leak was in the Manhattan Project. (There wasn't one.) Watching the public shock at the cloning of Dolly the sheep, long-term *Astounding/Analog* readers couldn't help being amused; they'd known for decades that such things were on their way.

On the other hand, sometimes something major sweeps through the real world that virtually nobody foresaw—like the tiny, powerful, ubiquitous computers now used in every aspect of producing this and almost any other contemporary magazine, and the big social changes coming out of linking vast numbers of them together. That's why it's so important for writers to consider not only the obvious possibilities, but the apparently far-fetched. We've long tried to explore both kinds, not only in our fiction, but in fact articles and columns that tell you about things going on on the frontiers of research—things that may look like mere curiosities now, but in a decade or two may radically reshape the world. *Analog* was, for example, one of the first places many people read about the vast potentials of nanotechnology, an impending revolution likely to dwarf the Industrial Revolution in its effects—in a fact article by the founder of the field, and in stories by writers exploring a great many of the ways it might transform lives.

Astounding/Analog has long featured some of the best and best-known writers in the field, both after they got that way and before anybody else noticed them. These pages were where Isaac Asimov and Robert A. Heinlein first came to prominence, and later Poul Anderson and Gordon R. Dickson, to name a very few. The immensely popular worlds of *Dune* (Frank Herbert) and *Dragonflight* (Anne McCaffrey) first appeared here. Still more recently, we've been proud to discover and/or cultivate such writers as Timothy Zahn and Michael F. Flynn. We've won a good many awards along the way, but awards have never been our primary goal.

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First issue of *Astounding* January 1930 ©

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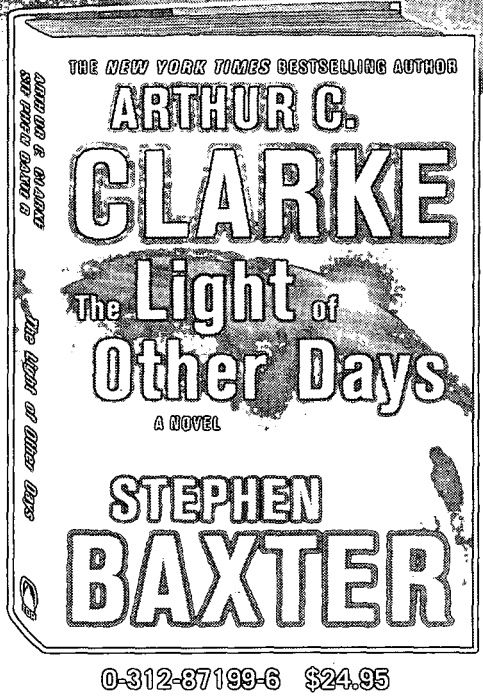

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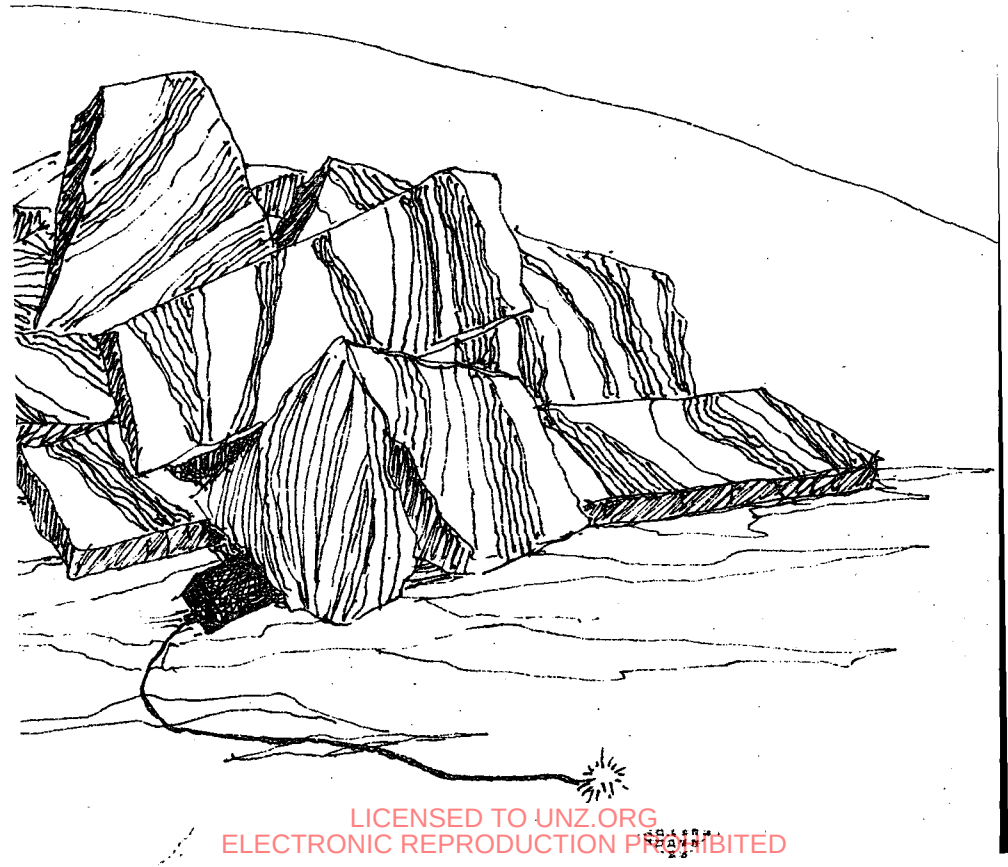
Hal Clement

UNDER

The newest Nebula Grand Master returns to one of the best-known exotic worlds in science fiction—and finds the Mesklinites confronting a new kind of danger.

Illustration by Kelly Freas



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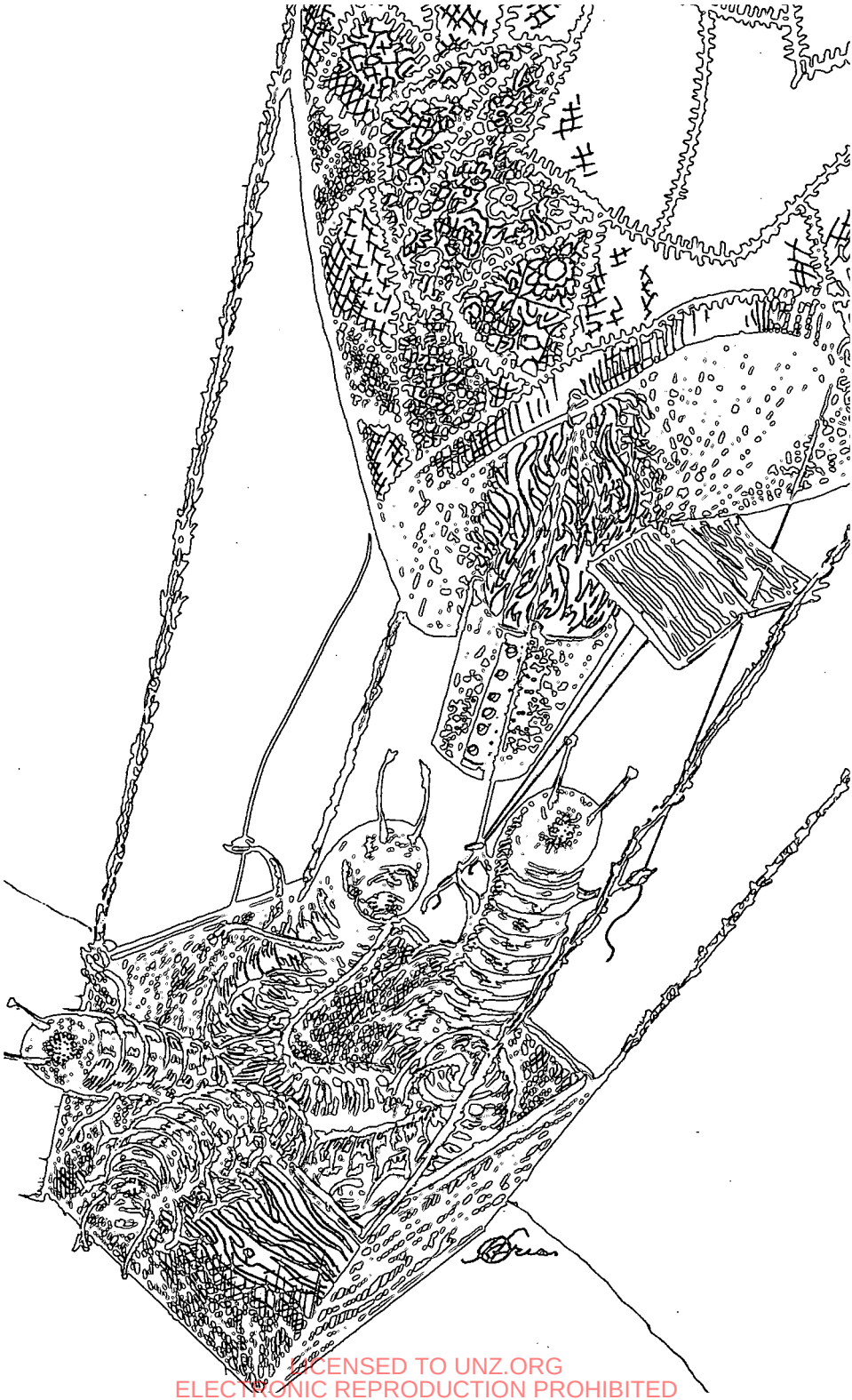

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WHAT HAS GONE BEFORE

Mesklin is the single "planet" of 61 Cygni A, the brighter member of a binary system approximately eleven light years from Sol and Earth. While several times as massive as Jupiter, it is not a gas giant; like Earth, it lost nearly all its hydrogen during formation. Predictably, most of its mass is concentrated in a core of degenerate matter, and its total volume close to that of Uranus or Neptune.

It has attracted astrophysical attention since its first well-resolved images were obtained, for several reasons.

First, shape. It is close to rotational instability; with a day of less than eighteen minutes, its equatorial radius is more than twice the polar one. Inertia gives it an equatorial surface "gravity" only three times that of Earth; the polar regions, lacking centrifugal effects and far closer to the ultradense core, would flatten a human being under several hundred times his normal weight.

Second, physical nature. The original accretion heat has been lost completely enough to leave the surface temperature at roughly radiational equilibrium; the oceans are principally liquid methane, the atmosphere nearly all hydrogen with a surface pressure of about eight bars. It is not clear why settling of mantle mass has not increased its spin rate for the last few billion years so as to cause general breakup and forestall the development and normal evolution of life. (The planet has several rings, which might possibly have formed from such an event; but rings don't ordinarily last for eons.)

Nevertheless, physicists rather than planetologists had most to say about its original detailed investigation. A remotely controlled spacecraft was landed at the south rotation pole to conduct experiments in the hitherto unattainably intense gravity field there. Much information was transmitted to the researchers at a base on the inner moon, Toory, and much more was expected to be obtained on physical records when the craft returned. Unfortunately, it failed to respond to the liftoff command, causing extreme consternation to researchers of some ten worlds whose people had contributed to the project.

However, a sop had fortunately been tossed to the planetary specialists and biologists in the form of a manned observing station near Mesklin's equator, where human and similar beings could, with precautions, stand the gravity for a time. Citylike patterns had been observed, with some uncertainty, in the mid-latitudes; and while there was little reason to hope that beings evolved for such conditions would be found anywhere near the equator, efforts involving firework displays and extremely loud sound broadcasts had been made to attract their attention.

These had been surprisingly successful. Barlennan, a sailor-trader-explorer of Mesklin's seas, had discovered the station. Charles Lackland, sole staff member of the outpost, had managed to make linguistic contact and, after much effort, teach some of his own language to Barlennan and learn some of the latter's Stennish.

At the start of Mission Of Gravity, *a bargain had been worked out. Barlennan's crew would travel to the south polar regions, and try to salvage as much as possible of the information in the grounded rocket. They were physically able to stand even the extreme gravity of the planet's poles; their fifteen-inch-long hemicylindrical bodies, supported on numerous stubby caterpillarlike legs, were* tough. *They were neither arthropods nor vertebrates; their flesh was resilient enough to need neither internal nor external skeletons. They did not breathe in any usual sense; their energy was derived from reducing highly unsaturated hydrocarbons and similar compounds with atmospheric hydrogen, and they were physically small enough for adequate*

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supplies of this gas to reach their extremely small body cells by diffusion. Their ability to use oral speech stemmed not from modified breathing apparatus but from evolved organs originally corresponding to propulsion jets like those of terrestrial cephalopods.

The season was propitious; the deal was made near the end of the brief winter, and Mesklin's southern hemisphere midsummer nearly coincided with the periapsis of its orbit, so much of the journey would enjoy daylight (Mesklin's year is some eighteen hundred Earth days in length, and its orbit quite eccentric).

The Bree, *Barlennan's ship, was a mosaic of individual rafts equipped with sails and centerboards, and represented a fair example of his species' technological status. The ability of Lackland and his fellows to travel through the air aroused several different emotions in the captain, largely acquisitive and envious ones. He was perfectly honest by his own standards, but hoped to pry large amounts of usable, and saleable, know-how from his customers while carrying out their wishes—knowledge which he at first took for granted the Flyers would never supply willingly, and certainly not freely.*

The trip to the pole involved first a long overland journey to an ocean strange to the Bree*'s crew. This was managed by towing the vessel behind a tanklike vehicle driven by Lackland. During this stage of the mission, the* Bree *personnel encountered a number of adventures which put serious strains on their normal conditioning to avoid either falling, becoming vulnerable to falls by climbing, or allowing anything to fall on them. Events even opened their minds to such concepts as* throwing.

Having to climb to the top of the tank to escape rocks being rolled downhill on them, with essentially no time to debate the choice, was a typical experience. A more extreme one was provided when the tank's progress was blocked at the top of a cliff extending indefinitely in both directions across its path, forcing Bree *and crew to descend somehow. The sight and sound of a nearby waterfall did not help Mesklinite feelings.*

By the time the ship and crew had been lowered by block and tackle, raft by raft, to the ground below, reassembled, and refloated on the river fed by the waterfall, none of the crew members was as he had been. Whether any of them, Barlennan and his first mate Dondragmer included, was still sane by Mesklinite standards was debatable.

But at least the river led to the right ocean—the Flyers could assure them of that—and all were willing to go on. Lackland had to turn back, since there was no way to get the tank down the escarpment, but he had provided the natives with a number of communication sets complete with cameras. These could be used to talk with the Flyers on Toorey, and allow the latter to give advice and to see what Barlennan and the others were encountering.

But even at sea, familiar as it should be, there were disturbing experiences. The sailors were used to storms, of course, and even knew why ships should stay well away from any land during them: ocean level, even in high-gravity latitudes, rose enormously in the extremely low-pressure centers of such disturbances, due to the tremendous Coriolis force. A ship could find itself stranded surprisingly far from liquid when things had quieted down. Avoiding land on an unknown ocean, however, was difficult even with help from above, and at one point while at the still-low seven-g latitude, the Bree *found itself floating on a pond in a valley drained by what had once more become a narrow streamlet almost surrounded by low hills—low by Flyer standards—on a presumably not-too-large island.*

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The local inhabitants proved to be of their own species, but they flew. *They used gliders, launched by elastic cables, kept aloft by their pilots' knowledge of wind patterns. Here Barlennan began to realize that the Flyers were at least sometimes willing to supply him with knowledge if he needed it. They explained how the gliders worked, though using seagulls as an analogy proved ineffective, and helped with still more information when disagreement with the locals made an escape necessary. Dondragmer was able to grasp the concept of, and to build, a differential hoist to remove a group of deep-driven stakes barring the* Bree*'s course downstream to the sea.*

At still higher latitudes, the thin-walled dugout canoe which Barlennan had acquired along the way and was using to tow supplies collapsed and sank from second-order gravity effects, and once more the Flyers proved willing to explain, this time with no real emergency apparently involved. The Mesklinites already had a general grasp of Archimedes' principle, of course, but would probably not by themselves have figured out the effect of rising hydrostatic pressure near its keel on the displacement of the "hollow boat."

The travellers eventually reached the south polar continent, worked their way up a broad estuary and its source river to a point only a few miles from the grounded rocket, to find their way blocked by another cliff—almost perfectly vertical and some three hundred feet high.

They were at the bottom this time.

Observation from space indicated that the escarpment completely circled a continent-sized area, and sent the planetary physicists arguing fiercely how any such phenomenon could have occurred under hundreds of gravities. This did not help the mission.

Observation from above showed one break in the cliff some hundreds of miles farther up the river. The ship was tacked up to this site, finding a region where the escarpment had collapsed (why only here, people wanted to know). Barlennan and part of his crew worked their way up slope and across the boulder-strewn continent above, while the Bree *and the others went back downriver to wait at the point nearest the rocket. The crew above finally reached the cliff top above this spot, and set up block-and-tackle connection with the ones below as had been done with the first cliff long before.*

They then moved themselves and supplies to the site of the rocket itself—which towered far above them. Because of the gravity, it would have to be disassembled and each part removed and studied from the top. *The Mesklinites solved this final problem by spending many, many days burying the probe. Eventually they could reach its nose cap and start removing module after module, with no serious risk to the pieces by dropping them, under instructions from above.*

At this point Barlennan renegotiated the contract, insisting on unrestricted access to any scientific information the aliens could supply. The aliens, after convincing him that at least some of this knowledge would be beyond his grasp without a long period of basic instruction, agreed to start the latter—and they agreed much more easily than Barlennan had really expected in spite of the events along the journey. He was a little disappointed that it had been so easy; but Dondragmer, a basically curious being, was not bothered in the least.

Salvage and schooling began together, and went on for many thousands of Mesklin days. Mission Of Gravity *ended with the launch of the second* Bree*—a hot air balloon.*

Under *starts some thousands of days later still, toward the end of Mesklin's southern-hemisphere summer, with the*

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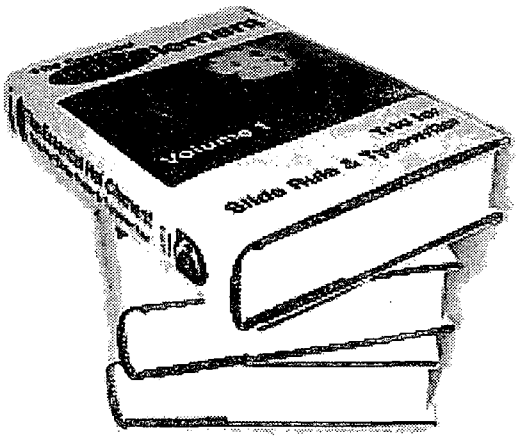

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dismantling of the spacecraft almost completed, and the planetary physicists pushing hard for a return trip to the equator by ocean. They badly want the Bree *to carry an inertial tracker salvaged from the rocket. The thought of the information about Mesklin's interior which should be obtainable on such a trip, with observations from space permitting the separation of inertial and gravitational data supplied by the tracker, is affecting the dreams of human and nonhuman researchers alike.*

"That looks all right. Come aboard, Cookie. *Then* reach out and light it. Hars, lift—*now!*"

Neither crewman acknowledged the orders verbally; they acted. Karondrasee whipped aboard in normal centipede fashion, scooped a coal from the lifting fire into the long spoon waiting for the purpose beside the furnace, reached through the handiest crenelation in the *Bree*'s mostly solid gunwale, and steadied the burning fragment over the frayed-out end of rope fuse beside the basket. He was't bothered by the form of address; there was need for haste, "Cookie" was shorter than "Flight Engineer," the duties overlapped heavily, and he was filling both of them. He was, however, annoyed and uneasy for other reasons; he had had to spend many days treating the three lengths of cord with meat juice and, as he saw it, wasting two of them. As cook of the old *Bree*'s crew he was used to seeing the results of his labors vanish, but he disliked seeing them burn up. That was the annoying part.

He was uneasy as well, because things might not work this time as they had on the two test burns. The first had not been dangerous, of course; it had simply served to show whether his juice treatment would really turn rope into a useful fuse. That sample was short enough to need only a day or so to make.

The second test should either not have worked at all or produced a simple, harmless fire fountain. By doing the latter it had encouraged everyone. Now the third and potentially most dangerous trial was under way.

The captain seemed unsure, too. He was watching the fuse as closely as Karondrasee was. So was Sherrer.

Hars was not. He was tending his lifting fire and eyeing the tensely swollen bag of the third *Bree*. He knew enough about the present test to want the ship to lift quickly, but if it rose *too* quckly, that would of course be the captain's fault. Hars was obeying orders.

That last thought was also in Barlennan's mind, and he was watching the delivery of the bit of fire tensely. If he *had* given Hars his order too soon—

Strictly speaking, he had. He felt the basket's deck stir under him, and saw the figures on the Flyers' instrument change. He would have stopped breathing for a moment if he had been a breather. Karondrasee, however, also knew the plan, knew what would have to be done if the fuse failed to light, and certainly didn't want to get out and push the coal to the right place while the balloon rose without him. As he saw his spoon rising slowly from its target, he tipped it over without waiting for an order.

No one actually saw the coal drop; falling, here, was much too fast for even Mesklinite vision. Cook and captain did see, as the air below it was compressed enough to speed its combustion rate by perhaps an order of magnitude, a sudden flash on the ground half an inch to one side of the fuse end. Before either could comment or even curse, the rope ignited—apparently from radiation, but conceivably from a flying spark, though neither witness could vouch for the latter. They didn't really care; the wadded rope-end was starting to glow, and that was all that mattered.

"Lighted all right?"

"Yes." Barlennan didn't bother to look

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at the block of polymer from which the question had emerged. "Hars, up as fast as you can. Never mind checking wind. I'd like to keep on this side of the rock to see what happens, but getting to the other may be safer and staying out of reach will be safest of all. I wish someone knew what 'out of reach' was, but if we do blow that way, *up* will mean a lot more than *sideways*."

"Right, Captain. Up it is."

Up it was. Not rapidly; it took a lot of lift to start an upward motion near Mesklin's south pole, even though once started acceleration tended to be high. That was why more than a thousand feet of fuse had been laid out, and the original test of its burn rate had been made.

"Please keep this eye aimed at the rock, wherever we go."

The block spoke again.

"Right. Sherrer will see to it," the captain responded, still without looking at the communicator. "We have you blocked up far enough to look over the rail already, and he'll wedge the back up more if it's needed."

"Are you set to turn it too, or will it be easier to rotate the whole balloon?"

"Much easier, though it'll cost a little lift. It will also make it unnecessary for you to look across the fire. Don't worry yet, it should take half a day to burn down."

"I never worry. I just wonder." Jeanette Parkos, who had taken up Charles Lackland's communication duties when health had forced him to return to Earth, was rich in comments like that. She had greatly improved Barlennan's Spacelang in the last few thousand days, and to his surprise and in spite of her alien hearing and vocal limitations she already spoke Stennish much more fluently and clearly than her predecessor ever had.

"I'd appreciate a bit of down tilt whenever Sherrer can provide it," she now suggested. "I can't see up to the horizon, but I can't see down enough for anything within a couple of miles, either. You're a lot closer to the rock than that, according to the tracker readout, and I hope you're closer still when it goes. I sometimes wish this thing had a wider field of view. Of course, I sometimes wish it could zoom closer, too."

Barlennan was not entirely sure that he shared the hope, though he wanted a good view himself. The Flyer was on Toorey, Mesklin's inner moon. Her communicator would let her see what went on. The closer to the rock the better for her, but nothing could, presumably, happen to her at that distance. Barlennan lacked both the distance and the seeing equipment, and wasn't sure which he missed more. The Flyers had assured him that there couldn't possibly be enough energy in the propellant cell now being tested to lift the rock above it any significant distance, but the Flyers had been wrong before. He remembered vividly the Foucault pendulum fiasco; they had been certain it would give a convincing demonstration, this close to the pole, that Mesklin rather than the sky was doing the spinning. Unfortunately no one, native or alien, had been able to observe the six-inch pendulum's plane of motion; its period was too short, and like any tuning fork its vibration had been damped out by the air a few seconds after it had been started.

They had all *heard* it, of course.

None of the Flyers seemed to remember that now. Barlennan had not seen an explosive in action since Lackland had used his tank's gun so many thousands of days before, since the previous cell test had produced only the hoped-for fire fountain; but he had been told in detail how such substances were used elsewhere in the universe. These accounts, and a vivid memory of the effect of the shells Lackland had used, left him wondering why no one seemed to worry about the behavior of *pieces* of the rock. Unlike Jeannette, Barlennan was a rather efficient worrier; he had not raised the question with her because he knew the aliens were extremely knowledgable in

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spite of their occasional slips, and he still didn't like to look ignorant. Answers beginning with "Of course" bothered him, especially in front of his crew, most of whom were now fairly fluent in the alien common language.

"Can you tell if it's still burning, and how far it has to go?" the Flyer queried.

"'Fraid not. The fire doesn't give any light to speak of by daylight. Too bad there's no night now—though if there were, we'd have to plan pretty tightly so the fire would reach the cell by daylight and we could see what happens to the rock."

"It might have helped, but since we couldn't be sure just when the fuse would run out—well, it's academic anyway. Even if you could control your landing point well enough you'd probably not have time to get there now, get out, cut the fuse, and start over. We'll just wait and hope. Good work, Sher; I think I see the rock now, though I can't be sure it's the right one. It *looks* like the pictures we got before, but there are such a lot of them—rocks, I mean—this close to the edge of the plateau that I could be wrong. Too bad that fuse doesn't smoke."

Since cooking fires on Mesklin don't normally smoke either and other kinds of fire are extremely rare, some minutes were used in explaining the last word; but someone remembered the Stennish for "fog" eventually, and there remained an unknowable length of suspense time when interpretation was managed. The earlier tests had given the Flyers some idea of the fuse burning rate, but the two had disagreed by over ten percent. Tension mounted, therefore, as the minutes passed.

Especially for the captain, as *Bree Three* was drifting toward the rock, keeping Sherrer busy and Barlennan worried. Their height *should* be great enough now to be pretty safe provided the aliens hadn't overlooked anything important, but there was no way to be sure they hadn't.

And, in fact, they had.

There was no flash; the cell salvaged from the rocket's liftoff equipment had been worked as far under the giant boulder as the latter's shape, the hardness of the packed ground, and Mesklinite psychology had allowed. A solid object several body lengths high and wide was not something a sane native wanted close to him, much less extending overhead, though the crew had gotten more or less used in the last hundred thousand days or so to the three-hundred-foot cliff edging the plateau. They were no longer, perhaps, wholly sane by their species' standards.

This cell held a directional charge like the other, its individual macromolecules oriented to send all the exhaust in one direction, and had been aimed slightly downward and away from the rock this time. It therefore started by digging up an enormous cloud of dust. None of the aliens on Toorey was an explosives expert, and none had considered all the likely results of blocking what should have been a free stream of hot gas with several tons of dirt, dirt very solidly packed by Mesklin's polar gravity.

Essentially, all the unit's directional qualities were lost as its reaction products hit ground and were scattered randomly. It might as well have been a half-ton-mass chemical bomb. The big rock did shatter. Being correct on this point did not please the captain as much as it might have; he watched tensely, knowing that if anything did go wrong there would be no time to give Hars a meaningful order.

None of the large fragments got far, and none could be seen in flight except near the tops of their trajectories, where they produced a hazy, discontinuous roof a foot or more thick and very little farther from the ground for a brief moment. Some of the much smaller stuff reached terminal velocity at other points, both upward and downward, and was visible very briefly to both Flyers and Mesklinites before hitting the

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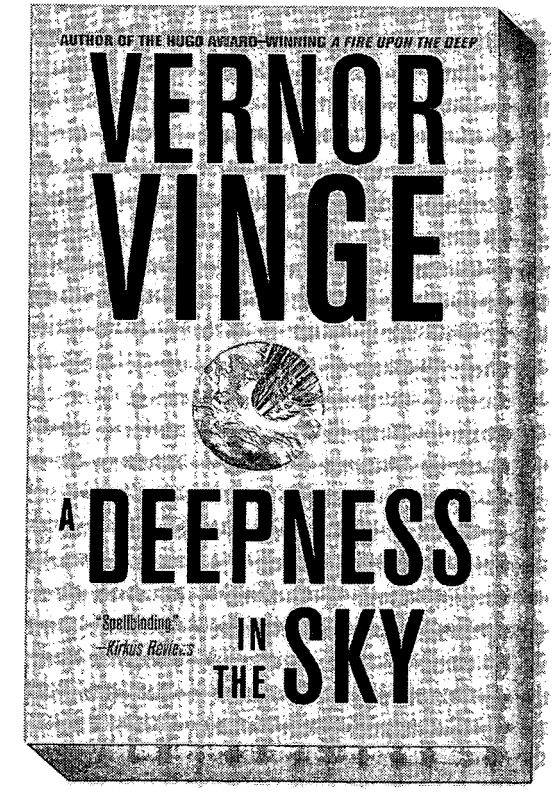

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surface again. Everything except for really fine dust had settled out before the sound wave reached the balloon.

This was least surprising to the natives. The quick-firing gun which had been used during the near-equatorial part of their earlier Odyssey had accustomed them to the sound of explosions, but had given them no clue to the speed of pressure waves in air. Their own voices had a volume astonishing to the Flyers, and they were aware in principle that there was a delay between hooting and hearing, but they had never considered the fact quantitatively.

The real trouble was that the crew of the balloon had, at the recent briefing, been assured that nothing of this sort should happen with a directional charge; it was supposed to take several seconds to burn out, waste much less of its energy in sound, and eject its gases in essentially all one direction as the earlier one had done. That one had been aimed straight up; this had been supposed to dig.

Barlennan added another item to his mental file of Flyer fallibilties. It wasn't really needed; the creatures had, carefully and often, made it clear that tested scientific beliefs were always tentative though usually more reliable than speculation. One could never, obviously, be sure that all the relevant data had been secured or properly considered.

"Hey! Look at that ripple!"

The alien voice was not that of Jeanette, but the captain understood it well enough. Ripples he knew about. Near the equator they could be watched quite easily, though close to the poles they moved much too quickly to be visible.

He also did not expect them on solid ground, here or anywhere. The word "solid" was a concept which to him did not include waves, large or small. The phenomenon was very brief; it was lucky he had been looking in the right direction. It *was* a ripple, flickering across the ground from where much of the smashed rock still lay, in all directions. The quivering of each boulder it passed was quite visible, rapid as the passage was. He realized that the wave had started and gone under the balloon before he heard anything, but only later realized—when it was pointed out to him—that the disturbance must have travelled faster than sound. He didn't bother to ask why even then.

The alien watchers on the satellite realized that the ripple must be a seismic wave, but none had a really good look at it just at first; it was out of the viewer field, close to the horizon as much of that was, in much less than a second. High-speed cameras had recorded it all, of course, but time was needed to play these records back, and there had not yet been time.

One of the Mesklinites, favored by a far wider field of vision, called attention to the real results of the blast.

"*Look!!*" The word was a bellow in Stennish, which Jeanette didn't bother to translate to her fellows.

"Show us! Let us look too!" she cried. "Where? What? Turn the lens!"

Sherrer was a little slow in responding, his attention being focussed toward a spot at the edge of the cliff, half a mile from the balloon and from where the rock had been, and at right angles to the line of sight between these. Barlennan reached for the rotation valve lines, but the balloon was slow in responding as usual.

Starting at the point nearest the blast, the edge of the precipice was starting to crumble away and, of course, to disappear. Cracks nearly parallel to the cliff face and up to a meter from it were appearing. Others nearly perpendicular to them were also showing briefly; then the outer sides of the prisms they outlined were leaning slightly farther out and promptly vanishing. New cracks closer to the balloon than the new edge appeared immediately, outlining sections which were vanishing in turn. The disturbance was spreading in both di-

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rections from the point where it had started—the point where, Barlennan realized, the "ripple" must first have reached the cliff face.

His memory flashed to the rockfall, hundreds of miles away, where he and some of his crew had first climbed to the plateau tens of thousands of days before. That had not stretched very far along the cliff. Right now his people and vessel, the original *Bree*, were ten miles along the edge from this new point of collapse and should be safe—

If this one spread no farther than the other. Neither he nor any of the Flyers had been able to explain what had caused that other fall. A vertical cliff three hundred feet high and of any length at all near a Mesklin pole was unbelievable enough; the now well-determined fact that it completely rimmed a continent-sized area of the giant planet was worse.

The general layered appearance, which the Flyers claimed to mean sedimentary rock, was hard even for them to reconcile with an unbroken vertical cliff. There should be rock fragments—more reasonably rock powder—at the bottom. All along the bottom. Barlennan had often heard them arguing about whether the perfectly vertical joints in the cliff face implied that the plateau had been lifted or the surroundings lowered, but it had been another of the inconclusive debates which seldom held his attention for long.

No guess at what might have caused that local fall had ever come close to explaining why it had stayed local; it was easy to imagine something like a careless footfall's (whose?) starting the break—but what could possibly have kept it from dominoeing both ways the whole ten- or twelve-thousand-mile circumference of the continent? And for that matter, what had studded so many thousands of square miles of the plateau's outer edge with boulders up to truck size, most of them lying *on* the surface rather than even partially buried? No one on Toorey was in the least surprised that Mesklin showed tectonic activity, and no one was too surprised that this differed in detail from anything familiar to Human, Drommian, and the other researchers' experience.

The edges of the plateau which had been seen, only a small fraction of its total circumference, did appear to be sedimentary rock, but this did nothing to make theorizing simpler.

Would the same unknown cause, or any other, operate to stop the spread of this fall? *Were* his crew members safe? The original *Bree* was ashore on the far side of the river, a little farther from the base of the cliff than the scarp itself was high. Many of those below would be away from the ship, farther still from the cliff, hunting, and presumably safe. Others, though, might well be fishing, since the river was a major source of food.

There was nothing Barlennan could do. The Flyers were still calling for attention. There was nothing they could possibly do either, but they deserved to watch. Barlennan was a responsible and reasonably fair-minded adult, and never thought of blaming them for what was happening.

The slow swivelling of the balloon finally brought the lens to face the cliff edge, not at the nearest point but well to the right, where the unaffected edge itself could still be seen. The captain stopped the rotation there. The new edge was now much closer to the balloon and—

And its growth was slowing? Surely it was slowing?

Barlennan's people, after many thousands of days piling dirt and rocks around the alien rocket in the course of business, had a very clear concept of angle of repose. The collapse couldn't possibly extend much farther back from the original edge than it was now getting, the captain told himself. The whole plateau would never crumble to fragments, obviously. At least, it hadn't the other time.

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But that was not the immediate problem. How far *along* would the disintegration extend? How safe were his other men? And how would he get his people and the stuff the Flyers wanted to recover physically, such as the inertial tracker, back to the equator if his original ship were lost? Taking the balloon across thousands of miles of ocean was ridiculous; it could carry fuel to heat its air for only a few days, in spite of Karondrasee's endless research into different juices with maybe more effective enzymes. It could not carry the whole crew, even if the stuff wanted by the Flyers were all left behind.

"We've warned Dondragmer." Jeanette's voice caught the captain's attention at this point in his thoughts. "No one is on the cliff side of the river. A dozen are away hunting. The ones still at the ship are getting as far from the river and the cliff as quickly as they can carry the radio."

"Can they carry it while keeping it pointed so you can see what happens to the cliff, and tell me?" asked Barlennan.

"Don said he'd try." That was enough for anyone who knew the mate.

"Can you see from it right now?"

"Yes. It's pointed along the cliff in the direction the fall will come from, but the view isn't too steady."

"North" and "South" were not useful words this close to the pole, though the latter had been located very exactly long before.

"I'd suggest there can't be any danger farther than, say, three times the river's width away from the cliff foot. When they get that far, maybe they could put the set down occasionally to give us a steadier look and better pictures."

"Maybe. But leave that decision to Dondragmer."

"Of course. But you still have two cameras besides that one; maybe he could leave it—"

"We've been using all three. Dondragmer decides. I know what I'd do with my present knowledge, but he's *there*."

"All right." There were beings, most of them non-human, on Toorey who might have argued further, but Jeanette Parkos was not one of them. She was very conscious of who was in charge on the surface, and as chief communicator realized clearly who would be blamed if any major disagreement should develop with the Mesklinites. "We'll report to you as well as we can when the collapse gets in sight from where Dondragmer is, if it does."

"Good. I'm still hoping it won't. That other one we climbed to get up here—"

"The other one is much narrower than this one is already. Whatever caused it can't have been as energetic."

Another alien voice cut in. "That's silly! Practically all the energy involved now is coming from falling rock. You have a chain reaction."

"But that must have been true for the other fall, too!"

Barlennan turned his attention back to the still-spreading collapse. He had learned long ago the futility of listening to Flyers arguing theoretical points when anything was actually going on. They got too far behind real time much too quickly. No doubt it was because they were too far away to feel personally involved. The captain was not; he turned his eyes back to the explosion site.

At least, nothing more was flying through the air. Their own climb had ceased, according to the tracker and his own eyes; the balloon had reached its ceiling, which was low because of the rapid decrease of air density with altitude. Hars' efforts were now focussed on keeping its height constant; altitude control was highly unstable. Even a slight dip caused a decrease in balloon volume, and hence a decrease in lift, which tended to make the dip deeper. It was like the hollow boat's behavior so many gravities to the north. Hars had developed a high skill at handling this problem; it had been he who had conceived the deflectors which gave quick

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control over how much hot air was actually entering the bag, and eliminated much of the control lag involved in merely feeding fuel or sprinkling meat juice on the fire.

"It's coming." The human voice sounded less excited than the captain felt was appropriate, but Jeanette was not, of course in danger herself. One should make allowances.

"How close?"

"It's just come around the point about three miles upstream."

"How far is the debris spreading out into the river?"

"I can't tell very well yet. The set is on the ground, or as near as no matter. The edge view I get for the bend seems to show repose at about forty degrees for the stuff near the top, and maybe twenty near the bottom. That would mean anything that's more than about one cliff height away from the original bottom should be safe."

"That does not quite include the ship," Barlennan pointed out.

Dondragmer cut in. "There wouldn't be time to get back to the ship, much less to tow it overland any distance, before the fall gets here."

"All right. Make sure the crew is safe. Head for the site where this balloon was built; that has to be safe, and a lot of our stuff is there anyway."

"Yes, Captain. We'll start searching for shipbuilding materials at once, when we get there. Have you further orders?"

"None for now, except when you think you're far enough out to be safe you should set the Flyers' eye where they can see what happens. Remember they can see things over again, and could be able to tell us how best to find and recover anything that gets buried."

Dondragmer was probably the least susceptible of the Bree's crew to being startled, and had spent many thousands of days burying and then digging out the alien rocket, but the thought of excavating a rockfall jolted him. Several of the crew could tell this. None, however, said anything, and the communicator was set down and pointed as the captain had ordered. The natives stayed where they were afterward, and nervously watched the collapse region as it neared them.

They could see that the falling material was pretty certain not to reach them, but Mesklinites in general are not calm about *anything*'s falling. Not even Mesklinites with the background of Barlennan's crew.

The roar of the rocks was loud enough now to drown out even their voices, and there was no conversation as the wave thundered past in front of them.

From Toorey, the view through the lens involved less emotion, though several of the watchers were already, and everyone hoped prematurely, wondering what the loss of the original *Bree* would do to their plans. More were observing, in as much detail as the optics allowed, the way new vertical joints appeared closer and closer to the watchers, delimiting sections of rock which began to tilt slowly outward—a slow fall was a phenomenon on Mesklin—and then develop horizontal cracks which shot back toward the areas already bared by the downward disappearance of previously loosened material. The rock above each crack tilted slightly outward and vanished in its turn, reappearing as it shattered on the growing slope below. Lower segments of the falling prisms were just as invisible during their falls, but didn't fragment as completely before coming to rest. The repose angle grew steeper as the eye travelled upward and encountered less and less fine material and more and more large slabs and columns.

On any other world the details would have been mostly hidden by dust—with or without an atmosphere to suspend it.

Not on this one.

The collapse wave thundered past. Dondragmer retained enough presence of mind to turn the vision set to the left, so the Flyers could keep watching its

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progress. This was just as well, because it let them see its sudden halt.

The wave was fully two miles past by this time; whatever stopped its progress could not have helped the ship still on the riverbank. But it did stop.

Within seconds, the debris seemed to have reached equilibrium. The observers, local and offworld, found themselves looking at a new straight-up cliff far to their left extending *inward* from the former face, roughly toward the grounded rocket. Its lower section was partly hidden by the scree slope so suddenly formed, but what could be seen was as nearly vertical as the original had been.

Several of the Mesklinites, rendered more nearly insane than their fellows by the events of the last thousands of days, promptly started back toward the cliff, slanting downstream to get a look at the end of the fall. Dondragmer was equally curious but ordered them back. Jeanette interrupted his commands.

"It's probably safe enough, Don. The stuff must have reached repose angle right away."

"No doubt you are right, Flyer Jeanette, but we will first bring the captain up to date with events. He could not have seen this, unless the balloon has moved remarkably fast in the right direction. You would know better, but I can't see it from here. Also, you do not mention that the repose angle, if it really is that, is much steeper for the higher, larger fragments than for the much finer material near the bottom."

"You know," cut in another alien voice, "this will be the first chance we've ever had to get a close look at the rock making up that cliff. We could see it was sedimentary, if horizontal layering means anything, but all we could tell was that the bottom fifty feet or so was light grey in color, the next layer up was a lot darker, and for the rest of the way up there were variously light and dark bands up to the nearly black one at the top. That one's silicate—mostly amphibole, the gear on the rocket told us years ago right after the landing, but this will be the first time we'll be able to tell anything about the other layers."

"*What* will we be able to tell?" snapped another. "Just what will color tell us, and what else will we be able to see?"

Dondragmer, like the captain, tuned out the argument. He had more important problems to face.

There was no more visible rock motion anywhere along the fall; the stuff must, indeed, have reached some sort of equilibrium. There was no more sound even from the left, where falling material must presumably have taken a little longer to fill space around the new corner.

But something—the "smoke" described a little while before? well, maybe ordinary fog—was *rising* from the far side of the river, over the newly fallen material. Even after watching balloons, the sight of something flowing upward was startling. Explanation would have to wait, though.

There were fragments of all shades and several colors at the bottom of the fall, but the mate was more concerned with what might be *under* it. What had happened to the *Bree?* And for that matter, what might have happened to the river? He didn't worry about the captain, who had presumably been almost as much out of danger as the Flyers. After a few moments' thought, he headed toward where the ship had been, ordering a few of the crew to come with him carrrying the communicator, and sending off others to examine the edge of the fall both up and down stream.

Almost immediately he had a question to ask the aliens above.

"It's getting a lot warmer as we get near the fallen stuff. Can you suggest why?"

Even Jeanette could, but one of the scientists undertook the explanation. Not even Dondragmer had really grasped much thermodynamics yet, but

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many of the natives had a fairly clear idea of energy. Every falling pebble had lost a lot of potential—

Quite a lot. More than enough, for the stuff originally near the top, to bring its temperature above the melting point of water, one of the aliens figured. Not that any of the natives knew what water was, or that there was any reason to believe there was any around.

"Better stay away for a little while," the alien concluded his or her remarks. "It shouldn't take long to cool again; your air is a very good conductor of heat. Actually, it must be radiation you're feeling; there ought to be a pretty strong wind from where you are *toward* the cliff."

"There is. It's still uncomfortable, but we can stand more if we have to."

"Just wait a while."

The mate saw nothing else to do.

Barlennan would have done the same, if the choice had been offered. Hars had worked the balloon rather jerkily downward from its ceiling until the basket was only a few yards above the tallest boulders, but at every level the wind was now toward the cliff edge. It was carrying them far too rapidly for a safe landing; hooking the car on a boulder and tipping the crew out was not acceptable. They could easily have fallen several body lengths. The cliff edge—or rather, the nearest point of the new slope—was less than half a mile away; much less, now. It seemed safest as well as unavoidable to go out beyond it and drop below the level of the plateau, a maneuver which should at least provide a wider choice of wind directions.

It didn't. There still was only one choice, it turned out. A little later, after his quick physics lesson, Dondragmer could have told his captain what the choice would be, but the information would have been of little help.

As *Bree Three* neared the top of the slope, the temperature rose abruptly, the balloon started upward, and the surroundings faded from sight.

Neither the need nor the possibility of instrument flying had ever occurred to Barlennan or any of his crew. They had felt the upward surge, tiny as the acceleration was compared to the local gravity, and the captain could tell from the tracker readings that the climb was continuing. The instrument had been the first one salvaged from the very top of the rocket; its main purposes had been to help guide the original landing, with the additional hope that if the south pole were not found exactly its distance from the rocket could be determined and, possibly, seismic measurements be secured later.

To Barlennan, the temperature rise plus the upward acceleration suggested an upward air current heated from below and outside the balloon; Hars judged the same and reacted at once, slanting the vanes to waste hot air to the sides. The captain's first thought was that this was the proper reaction; then he realized that the climb couldn't possibly last long, but might very well take them above the balloon's normal ceiling. If the upward impulse ceased at some point, which it could hardly help doing, even full fire might not be enough to keep a catastrophic descent from following.

"Keep it hot! Hot as you can!" he hooted. The fireman reversed the slope of the guides without question, though perhaps not without uneasiness. For several seconds the crew remained without reference points, though the figures on the instrument showed they were still climbing; then the surrounding fog began to thin, and sun and sky could once again be seen.

The ground directly below could not, nor that along the former line of the cliff edge; they were still in fog. Toward the plateau, however, boulders were visible once more. In the opposite direction the less rugged area of the lowland showed fuzzily at first, but quickly cleared. Evidently they were still travelling in the same direction. A glance at the inertial reading confirmed this.

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The readout was reliable to fourteen places, even here; it had been made visible on the surface of the baseball-sized sphere to permit initial calibration, and Barlennan was not the only member of his crew to have learned to interpret the characters. Hexadecimal readings weren't too difficult for people who normally used base eight. The tracker was completely solid, with no moving parts larger than electrons, and the gravity had produced no readable change in its behavior, the Flyers had reported. It had, after all, been designed for such a field.

It quickly became just as evident that the expected descent had started, and Hars, without further orders, heaped more fuel on the fires. Karondrasee sprinkled a contribution from his juice tank. Barlennan looked upward rather than at the approaching ground; wrinkling of the balloon fabric from rising pressure would mean more than the narrowing of the space still below them, however read. It occurred fleetingly to him that a small sealed balloon at regular temperature might serve as an even quicker method of determining rate of descent. One could watch it swell toward full or crumple toward flatness.

It would also be something they should be able to make themselves. There would be no other inertial instruments until they got back to the equator, where Flyers could land.

But that could be thought out later, if he were alive to think about it. They were descending fast now, as even vision could tell when he glanced downward, but at least the skin was still smooth. The balloon was maintaining its volume in spite of the rising outside pressure; Hars was doing his job.

The possibility of the bag's bursting during a climb had bothered the crews during the earliest flights, but the Flyers had assured them that the opening through which hot air entered it would never let the pressure get too high inside.

Again fleetingly, Barlennan wondered whether they might be wrong again.

They weren't, this time. The descent slowed and stopped, though it was fortunate they were no longer over the plateau. The cliff now was hidden by the same fog which had concealed the rest of the world on the upward surge, and the numbers said they were over a hundred feet lower than the rocket. At this point the voice of Jeanette, which had been surprisingly silent for the last few minutes, sounded again.

"Captain, what's happened? Where are you? We can't see anything but the sort of ground across the river from the cliff, and it doesn't have enough features for any of us to recognize. We can read the tracker, but can't match figures with landscape yet. Can you turn the eye so we can see the cliff and the boulder country?"

"Turning," Barlennan replied, gesturing Karondrasee toward the rotation lines. "I'm not sure, but I think we're pretty close to where the test was made, only we've passed the cliff. If it still is a cliff. Can your eye see through fog? If it can, you'll know better than I where we are when you look back. Where's Dondragmer? I should be able to—"

"I can hear you, Captain. I can't make a very good report. The falling of the cliff stopped a couple of miles after it passed us, but we can't get back to where the ship was yet. It's too hot. The Flyers say that's to be expected, and at least the lower part of the fall is producing fog too dense to see through. Luckily the wind's now blowing toward the rockfall and keeping fog and heat away from us, but we can't get really near the ship yet."

"Can you see enough to guess whether it escaped?"

"No, sir. And if it's still uncovered it may not stay that way long. If you and the balloon were here you could tell better than we can, but it looks to us as though the very bottom of the fall were still moving this way. More like flowing than falling."

"I see the wind near the ground

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where we are is also moving toward the rocks, and now that you mention it, I think we can see that outward flow, too. We'll see it better when we get closer; we've let down pretty far—more honestly, we were pretty low when Hars killed our drop—and yes, we're blowing back toward the cliff now."

The conversation had been in Stennish, but Parkos had been able to follow it.

"Then you'd better climb again, Captain!" she cried. "If you're carried too close to the slope—well, I don't know how much heat you can stand, but you'll be cycling though that updraft again. You'll be starting from lower down, where it should be a lot hotter!"

Hars spoke as he manipulated the guides, without waiting for orders. "Worse than that, Captain. I don't think we have enough fuel to manage another descent like this one. We'd better get up into the flow away from the plateau, get some more distance, and then land before we're carried back in again. The fog up there is blowing out past us the way we need to go, so there's a good wind not too far up."

Barlennan gestured assent to the fireman.

"Don, you must have heard that. Unless something serious happens, we won't call you again until we're on the ground. You can tell me anything you think worthwhile. Jeanette, you must have had a good look at the fog yourself by now. Can you see through it?"

"Probably no better than you. We can see the stuff lifting from the rocks at the edge of the slope; they must be pretty hot. Did you smell anything, familiar or otherwise, while you were in it? We're trying to guess what could be boiling."

"There was some ammonia. Nothing else I could tell, but ordinary methane seems likely, too. How about the rest of you?" The others gestured negatively.

"That's interesting just the same. Have you smelled any ammonia since you left the equatorial regions?"

"No. Not that I can remember." Once more the others agreed with him.

"It's hard to see how that stuff could be so far from the equator at this season," remarked another human voice. "I'd expect most of the planet's supply to be frozen in the other hemisphere right now."

Once more the captain focussed his attention on his more immediate problems. Hars had found the wind they needed and was holding altitude with his usual skill, and the line of fog was once more receding; but the fuel was getting very low indeed. It would not be good to let down into the other wind too early, of course; but if it took them too long to reach a safe distance, there might not be enough fire to make the descent and landing safely.

"Your judgement, Hars," the captain said. "Get as far as you think will let us down without flattening us. Don't wait for my orders."

The fireman gestured understanding without taking his attention from his levers. Barlennan had never learned to like situations where he wasn't in personal control, but he had long ago learned to be a captain. There were situations which didn't leave time for orders.

In Barlennan's opinion, his pilot started the letdown too soon, but he said nothing. Hars almost certainly had a better idea of how much fuel the descent would take, and if the pilot was actually allowing a greater safety margin than the captain thought necessary, there was an excellent chance that he was right. Watching the balloon's still wrinkle-free skin seemed wiser than interfering. At least, any dents would appear near the bottom first.

It had occurred long ago to one of the alien watchers that if the lower half of the balloon were to cave in sufficiently, the bag might serve as a fair parachute. She had then calculated the terminal velocity of the resulting system in the polar regions and decided not to mention

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the idea to anyone. The resulting ignorance spared the captain some worry.

Barlennan was partly right; the descent had started too soon, from one point of view. They were in the grip of the cliffward wind well before they reached the ground. It might, however, be too late as well; the fuel was going rapidly. The natives were unfamiliar with alien literature and would probably never have thought of using part of their basket for the fuel. This was probably just as well, since anything which distracted Hars from his piloting would very probably have killed the four of them. As it was, they were saved almost certainly by the fact that something else was approaching from the direction of the cliff.

It was not methane. At least, it certainly was not ocean-pure methane; it could barely be called a liquid. Slush or mud would be better words. It lay under them as the supporting heat dwindled below the ability of the guiding deflectors to keep the balloon contents hot enough.

The first wrinkles appeared in the bag; Karondrasee's bellow of alarm just barely preceded contact between the basket and the semi-fluid. The car stopped almost at once, after a fall violent enough to make the stuff splash and jolt the occupants severely; the bag took rather longer to touch. The cordage tried to pull the basket toward the cliff as the wind still dragged at the balloon. For just a moment Barlennan thought the car would be tipped over and dump its fire, and had enough time to wonder what would happen when the latter met the whatever-it-was; then it appeared that there was enough weight stuck—frozen?—under their feet to hold them nearly level.

They were more or less safe, it appeared, for the moment, but like Dondragmer they were uncomfortably warm.

There seemed no practical way out of the basket for the moment; the stuff surrounding them appeared dangerously hot, and there was no way to tell yet whether this would get worse, or better, or remain unchanged, not that the last would be much help.

The captain didn't bother to ask the Flyers anything.

"Dondragmer, can you hear me?"

"Yes, Captain."

"Have you been able to get back near the ship?"

"We're closer."

"How's the heat? We're down, but are stuck in some sort of goo. There's a lot of ammonia smell, but it doesn't look much like ammonia."

"That's happened here, too. It's what's keeping us from getting any closer to where the ship was. It looks and smells to me like the methane-ammonia slush we saw a good deal of where we wintered and met the Flyers, but that may be just a guess. If it's right, the ammonia should freeze after a while and sink and leave ordinary methane on top, which should soon be cool enough to swim in. The Flyers won't commit themselves either, but agree we should watch for clear liquid to show on top of the stuff."

"I hadn't thought of that, but here we'll have to wait anyway. I hope we don't cook while we're still waiting."

"Is your fire out? Or is there any chance of flying the *Bree* again?"

"None, I'd say, unless we can get rid of whatever is stuck all over the bottom of the basket and must have kept us from tipping over when we hit. Maybe we should take a chance on putting the heater out. I've been a little uneasy about letting fire get near the stuff around us, or vice versa, because I thought that might burn too; but if you're right there won't be any trouble."

"*If* I'm right. Pardon me for sounding like a Flyer, but I said I was guessing."

"Now that you've reminded me, I'm guessing right along with you. In any case, it's getting warmer all the time

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here, and something has got to be done."

"How about just going over the side, and seeing if being farther from your fire will be enough?"

Barlennan did not answer at once. If such an experiment were to be tried, there was just one person who would have to go over first. He temporized briefly.

"There's no sign of the stuff settling, where you are? No liquid on top?"

"No. If it's going to happen, it should be upstream where you are, first, I'd guess."

"*Is* there any stream? There doesn't seem to be any flow here."

"No. I suppose the fall blocked it."

"But the methane from upriver should flow around, and even if the original bed was filled with rock the river should just be pushed out farther from the cliff than before."

"Maybe it was," the mate answered thoughtfully. "Maybe that's the liquid part of this stuff. But if it is, I wonder where the ammonia came from?"

"We're arguing like Flyers," the captain cut off the debate. "I'll reach over and find out how hot this stuff is."

The caterpillarlike Mesklinite anatomy was not constructed for toe-dipping; Barlennan had to reach over the side with one end or the other of his body, and lower a set of pincers into the stuff. He chose to use his head end, for whatever help his eyes might give him.

"Barlennan?" it was Jeanette's voice.

"I hear you."

"Are you all right, and is the tracker still working?"

"We're uncomfortable but still alive. I haven't looked at the machine since we stopped. I don't suppose heat will hurt it, considering who made it. I'll shade it so I can see the figures and get a reading."

"Whenever you can, please. There are people here who will have trouble breathing until they learn its condition, now that we know you're all right. Its reading here hasn't changed for some minutes now."

Jeanette was not actually a skilled liar, but had some natural diplomatic ability. It seemed unlikely that the captain, just now, would be able to sympathize very well with people worrying more about the instrument's condition than his own.

"That's reasonable," Barlennan concurred. "We've been stranded for some time now. Here's what I read." He pronounced the symbols carefully.

"Good. That's what we have here. If it should change its reading, please let me know."

Another thought struck the captain. "Can you tell us whether the fall is still going on, upstream? Dondragmer says it stopped just below his location."

"It did. We can see clearly with his communicator. I can't answer your question. You're practically at the pole, we're over the equator. The only reason we can see your area at all from here is atmospheric refraction, which doesn't help the image. Otherwise you'd be below our horizon. We'd have to send out another mapping rocket."

"Do your people think that's worth doing? I'd be glad of any information I could get from that direction."

"I'll ask." The Flyer's voice fell silent, and there seemed no more excuse for delay in testing the slush, if that's what it was.

Gingerly, his head and a few inches of his body over the basket's gunwale, Barlennan reached a chela toward the nearly white stuff. The sun was low as always at this latitude and season. At the moment it was beyond cliff and fog, but there was plenty of light. He could feel some warmth from the surface of whatever-it-was, but it didn't seem as a bad as before.

About like the inside of the balloon bag, which had been found to be bearable much earlier when control lines had tangled in flight.

The stuff was soft, though it resisted a little when poked. Whether it would be

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firm enough to support his weight, and what would happen if it weren't, were still open questions. There was only one way to get answers that the captain could see. At least, only one which could preserve his self-respect; he *could* order one of the others to climb over. He didn't.

The stuff did resemble the slush they had encountered near the equator, as the mate had said. It was uncomfortably but not dangerously warm. It did not support him until he had sunk perhaps a third of his body volume. His report, when he finally got back in the basket with the assistance of the others and a length of rope, paraphrased history for some of the human listeners.

"Too soft to walk on, too hard to swim in. We're here for a while, but we can stand the heat. Have you tried it, Dondragmer?"

"Yes, Captain. You describe it well. We think we can see the ship, but whatever it is is almost entirely immersed in the slush, and we can't be sure. If it is, it's well to this side of the fallen rocks."

"Good. Find out for sure as quickly as possible."

The mate acknowledged the order, which both knew to be superfluous.

Half a day later, with the sun on their own side of the former cliff, nothing had been accomplished except testing the inertial tracker. This had been carried from one side of the basket to the other, and the change in readings on its surface and at the receivers on Toorey had remained in agreement. Barlennan was not surprised; from his point of view nothing at all violent had happened during the wrecking of *Bree Three*.

The slush was still slush. This surprised the Flyers, who seemed to feel that if anything were going to settle at all it should do it pretty quickly on Mesklin; Barlennan had no basis for an opinion, though he certainly wished that something would happen.

Fog was still rising from the slope a few hundred feet away. The Flyer prediction that the wind should cool the fallen rock fairly quickly seemed to have been another mistake. Barlennan didn't raise the subject; he was quite sure that the beings would point out that they hadn't actually specified a time numerically. This was quite true, and qualifed as an excuse even by the captain's standards.

There had been, twice, sounds from inside the fog suggesting that rocks had moved, and the four people in the basket were alert for anything more of the sort. Dondragmer's people had heard nothing like it, the mate reported; but they, too, were listening. Anything like that should happen upstream first, each told himself. This was not mentioned aloud.

The fire had not been extinguished after the captain's experiment, but was now dead for lack of fuel. There were plenty of Mesklin's scraggy plants in sight in various directions on the shore beyond the slush, but there was no way to reach them; and there seemed not to be enough of them to get *Bree Three* into the air again in any case. Karondrasee had plenty of meat juice in his tank, but there seemed no way to use it.

It was two whole days before anything noteworthy happened, and its development then was gradual.

There were more of the falling-rock sounds. Nothing could be seen; the fog, if anything, was thicker, and the breeze toward the rubble slope somewhat faster.

Then another quite familiar sound made itself heard.

"Captain! A current! Flowing—" Hars uttered the words very softly for a Mesklinite, though Jeanette had no trouble hearing him. She heard the trickling of liquid, too, since the pilot had been doing his best not to drown it out with his own voice.

"Which way? Can any of you tell?" she asked. Barlennan couldn't decide himself; the sound had seemed to come first from the direction of the rocks, then

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from what had been upstream, then from many directions at once. The most convincing came from the fog.

Flowing liquid? Methane? Was the ammonia, if that's what it was, finally starting to settle?

Methane, yes. Settling ammonia, apparently not. Motion caught the eyes of the four crewmen in several directions almost at once. Most of it was from cliffward and upstream, but Barlennan caught sight of a trickle which seemed to rise from almost under the basket, a rivulet which spread, and grew, and flowed downriver as he watched. Others appeared and behaved the same way, more and more, minute after minute; then quite suddenly, they vanished in a single spreading sheet of liquid which the crew now realized covered much of the landscape in the upstream direction. It was as though the river had resumed flowing, and was coming up *through* the slush, and making a new bed for itself beyond the tumbled rocks which had filled the old one.

It was methane, as taste promptly proved—it was not a laboratory situation to the Mesklinites, who were by now pretty thirsty anyway. The river was being reborn.

Yes, reborn. There was plenty of liquid coming from upstream, but there was nearly as much—perhaps more—welling up from under the slush and from the direction of the rocks.

The basket began to move, as Jeanette promptly reported.

"We know," the captain replied tersely.

"Will you float?" asked the Flyer.

"We should. The basket's made of wood—real wood, not that funny stuff from the ammonia flats. What we need to know is whether it'll float *level*. We didn't worry that much about weight distribution when we made it."

"How about the bag?"

"That's another question. We may have to cut it free. Depends whether it acts more like a sea anchor or a sail. Dondragmer, we must be heading your way. I can't guess how long we'll be getting there."

"We're watching, Captain. If you have to free the bag, we'll try to capture it, and you of course. The slush is still slush down here, but we're watching for liquid, too. If the thing we think is the ship starts to move, I'll take swimmers to do what we can."

"Good. We're going to be busy here, but one of us will keep in touch. If you don't hear from us for more than a few seconds, you'll know something we didn't expect has happened. In that case, send some people up this way to give any help they can. We're going faster, I think. The bag is dragging behind us, whether it's touching bottom or feeling wind I don't know. Probably wind, I think; there's an upstream component to that now, and the bag itself is pulling a little toward the fog. It's pulling us that way too."

"Hadn't you better cut loose, then, Captain?"

"Not until we can see whether moving in toward the rock is good or bad. We're standing by to cut if we have to. There doesn't seem to be anything yet for us to hit."

Barlennan kept a running commentary going, as he had promised, while basket and bag headed downstream. The nearest motionless objects were now either too distant—features on the land away from the cliff—or too vague, like the fog, to allow a trustworthy estimate of speed. It was one of the Flyers who pointed out that the tracker was moving downstream surprisingly fast. He didn't seem really sure that it was surprising; all earlier estimates of the river current had come from direction measurements of the communicator outputs, which were not very reliable with the line of sight to the moon practically horizontal. This was not the tracker's first trip to the lower ground, but was its first ride on what had become a surface vehicle.

One of the watchers remarked audi-

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bly that he was surprised the vehicle wasn't in white water; another, not bothering to correct the name of the liquid, suggested that the first speaker think gravity. Just what would "white" imply about the current's speed on Mesklin?

The twelve-plus kilometers an hour was several times any earlier estimate, however unreliable that might have been. It implied a source of liquid unrelated to what had been seen of the upstream areas from earlier balloon flights. This was not merely methane which had found its way, after some delay, around the recent rockfall.

The people on the basket finally observed this, too. The drag toward the rocks had been maintained as wind kept its grip on the now rapidly flattening bag. The sharp rocks were suddenly passing uncomfortably close to a structure which had been designed for lightness. Contact could be awkward even if the pieces continued to float, as they no doubt would. Barlennan heard himself commenting on this as part of his running report, and interrupted the monologue with a sudden, sharp order.

"All of you! Cut it free!"

Simultaneouly the bag caught on a sharp, solid rock corner, jerking the basket to a halt; anywhere near the equator the crew would have been hurled overboard. Karondrasee, in fact, did get jerked over the side.

For just a moment the cook could be seen borne away from the suddenly anchored car; then, as the others finished cutting the dozen cords which had held basket and bag together, the former resumed its downstream rush even more rapidly than before. It was now relatively motionless with respect to the swimmer, and he had no trouble wriggling back to what might or might not be safety. He needed no help getting aboard through one of the gunwale crenelations, and the fact that he brought a good deal of methane with him made no real difference. In spite of the total absence of spray, the footing on board was already extremely wet. During the brief halt, the river had spilled over the upstream gunwale and nearly washed several more objects into the river.

The communicator was high enough above the deck to stay clear, but the inertial tracker was not. Neither were the three remaining natives. It was Hars, perhaps more concerned with all things connected with flying, who curled his long body about the sphere, gripping it with every leg which could be brought to the task. Sailor and instrument washed rapidly across the deck in the direction from which Karondrasee was swimming, but they did not go overboard.

Hars' own display of personal strength surprised no one, but his fellows and the watching Flyers were all rather startled that the gunwale seized by one of his chelae did not tear loose from the rest of the basket. He uncoiled partly, still retaining his grip on the tracker, and spread the load on the gunwale with more pincers; by the time the cook was safely aboard, the sloshing of liquid across the deck had ceased and the tension had eased.

"It would have been easy enough to find," Barlennan remarked. "I know it would have sunk, but the river's pretty clear."

"Is the bottom solid?" a Flyer voice—again, not Jeanette's—asked pointedly.

"I don't know, but it looks—" The captain paused, then went on, "Just a moment." He vanished over the rail. His crew watched with interest but no great concern; the aliens were highly concerned but couldn't watch. The long body reappeared and moved in front of the lens.

"It might have been serious at that. It's the same slushy stuff, and it's travelling—not as fast as the river, but if the tracker had sunk we'd never have found it. Good work, Hars." The exhaled breaths were audible through the com-

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municator, but carried no meaning to the natives.

Dondragmer could not see anything nor hear everything, but had been able to infer what was happening.

"Is anyone watching ahead, Captain? You must be travelling pretty fast. We're getting ourselves and the radio back from the river; it seems from what you said it's a lot wider and faster where you are now, and that it became so very suddenly. All of us are staying with the radio as we move it; I'm sure the Flyers know that faster-moving methane carries things more easily."

"Sixth-power law," a barely audible alien voice muttered. The words were not in Stennish, but the mate understood both them and their mathematical implications. Barlennan got the former only, but no order was needed to drive the mate to greater haste. The captain had heard the question about looking ahead, and without acknowledging the words was doing so.

Actually, looking aside was more worrisome; the basket was still closer than he liked to the edge of the rockfall.

Worse—*much* worse—it could be seen that much of the finer waste from the cliff was being washed away by the current, leaving widening spaces between the larger fragments.

Well, the Flyers weren't *always* wrong, of course.

He could not see what was happening to the loosened stuff. The surface was too turbulent to offer a clear view below it.

He remembered his earlier promise and began describing the new phenomenon to Dondragmer. Sherrer, his flexible body partly overside, rotated the basket to let the communicator eye look ahead. His chelae were poorly shaped for the work, but his paddling did have results.

"You seem to be approaching a bend to the right, in both fog and river," Jeanette remarked. "I'd guess it's that kink—that point—in what used to be the cliff, a couple of miles or so upstream from where Don is."

Barlennan saw no reason to disagree, and the possibilities which a quick change in flow might offer were enough to focus his attention. "Dondragmer, is your part of the river widening at all rapidly? It should be if the Flyer's right. How well are you moving the radio? Can you keep it moving and also let it look upstream?"

"We are moving. I'm not sure about change in width, since we're away from the river itself now. We're keeping the lens pointed more or less upstream, but I'm afraid they're not getting a very steady view."

"Don't worry about that, Don. We can take pix when it's steady and look at them. You're right about keeping the viewer as safe as possible."

"Thank you, Flyer Jeanette."

It was indeed a turn to the right, the captain saw as they approached it. The current was visibly swifter; they were still close enough to the shattered. pulverized, and steaming rocks for this to be very obvious.

He suddenly realized that *everything* at the foot of the pile was much larger now; the fragments resembled the gigantic—to him—slabs and prisms which had earlier shown only on the higher and steeper part of the fall.

It was hard to tell from this close, but the general slope seemed to be steeper, too, as though the whole fallen mass were still gently sinking.

Maybe it was. The fine stuff below was certainly vanishing.

There was a fan of standing ripples angling out across their course ahead; the mate would almost certainly have been curious about this, but Barlennan was just uneasy. The river was still liquid. He felt it again to make sure. He did not, however, wonder what made these little ridges in it—only what would happen to the basket and its passengers when they reached them.

Which they would do in seconds.

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Would they be hitting liquid, or something solid enough to support those humps which lay a little *above* the general river level, or something slippery which would bend the raft's structure into its own shape?

It was liquid, both its high and its low parts, they found. Motionless waves were something new to Barlennan, and he reported as well as he could to his mate and the aliens. The basket was still intact, though everyone aboard had felt the deck under his feet follow the up-and-down displacement of the surface as they passed the still ripples. The Flyers seemed unsurprised, but Barlennan was not asking for explanations just yet.

The foursome ceased thinking about the ripples at once. The next event was prompt, less unfamiliar, and more frightening.

There was an eddy on the downstream side of the point, where the liquid swept around. They had all seen such things before, but never in gravity this high. If there had been time to think, they might have foreseen this one, though not in full detail. They had never, after all, *felt* one in gravity this high either.

Barlennan tried to keep reporting.

"We're around the corner. We can't see you, though—"

"I haven't seen you, either."

"Not surprising. There's a hollow in the methane, we're quite a bit below the river level, and can't see much but the rocks—when we're looking that way."

"Captain! What's happening? The eye and the tracker both say you're—you're moving in a tight circle. How can—?"

It was often nice to have the Flyers tell him what was going on and advise him what to do about it. It was sometimes nice to have them unable to tell him what was going on, thus providing a little salting to the flavor of omniscience they claimed not to want. It was not nice when he didn't know what to do about it himself. He described what was happening in as much detail as he could observe, and as he did so realized what was probably going to happen next.

The broad swirl of liquid cut in toward the edge of the rock slope and divided there, some swerving back upstream and some resuming its original journey down. At the point where the division occurred, the biggest rocks were visibly *settling* still. Not fast, but visibly. The finer stuff had washed out from between and among them, and the higher and larger items were crowding vertically closer to each other as the material originally separating them vanished.

The pieces were big. They were very big, and as the seconds brought the basket closer the face the slope began to change. It grew still steeper, and the spaces between the huge boulders seemed to open like mouths, leading into the face of the bank—with throats leading *under* it.

All four sailors were familiar with the hazard of *striking* rocks. They had even, occasionally, been swept between rocks.

But they were Mesklinites, and if any of their colleagues had ever been carried *under* rocks no one had ever heard about it.

The four paddled frantically but without much result, even after the captain got them all paddling in the same direction. The basket flung itself toward the bank, swerving only at the last moment, with some of the huge fragments close enough for even the Mesklinites to touch.

The swerve was upstream, back toward the point, which meant that they would be going through it all again. And perhaps again, and again . . .

The rocks were still quite hot, though the wind toward the rocky bank made things a little better. Methane striking the fragments didn't actually splash, though it did rise a short distance above its regular level before boiling into invisibility and reappearing as fog. Spray was

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extremely rare this far from the equator.

They reached the upstream side of the eddy, swept out into the main current once more, but were not yet free. It was going to be *again*.

But only once. They were carried back toward the fallen cliff somewhat farther downstream this time. The settling was still going on, but less rapidly; could one hope it was actually stopping? That the mud was nearly all gone, and the big fragments resting directly on each other? Well, yes, one could hope. There were no sounds of falling and grinding, after all.

The lowest part of the rockpile was now definitely much steeper and formed of really huge fragments, with open spaces between sometimes wide enough for one of the old *Bree*'s rafts; and the current was not dividing at the very edge any more. Methane was flowing *into* the interstices, flowing almost as rapidly as in the farther-out parts of the eddy. There was no way to paddle the basket fast enough and far enough either up or downstream to get it carried in either direction. It was going to travel *into* the wreckage of the cliff.

Not even the Flyers could find words. They could see it coming; their lens at the moment was pointing in the basket's direction of motion. None of them ever admitted whether the fate of the natives or the loss of the communicator and tracker concerned them more.

There were other communicators, of course, and Dondragmer might prove to be a better agent than his captain; but there was only the one tracker, and great things had been planned for it once it had been found to be still functional. If it could be carried over land and sea all the way back to the equator, while being followed from above by communicator waves so that gravity and inertial effects could be distinguished, what *couldn't* be learned of Mesklin's interior?

No one had yet discussed this project with Barlennan, and in any case it would not have been the captain's primary concern just now. He and his men were being washed underground, on what amounted to a patch of driftwood. It was much, much later before any of them realized how lucky it was that the sun was ahead of them, on the high side of the cliff, just then.

It grew relatively dark the moment they had rock nearly surrounding them, with only a modest illumination from the sunlit ground across the river. Their heads and eye turned back toward the light, and stayed there as the view narrowed; and before they really saw and could respond to the unimaginable tonnage of material suddenly *above* them, the darkness was complete except for the faint glow of the tracker's numbers.

The Flyers, Barlennan thought after a moment, should have commented on the darkness or the fact that the tracker was still indicating motion or *something*, but the communicator was silent. It remained so after several hopeful calls by the captain.

It had never occurred to him that whatever carried the messages to and from Toorey might be blocked by intervening rock. The concept of a completely surrounding bed of intervening anything had never crossed his mind.

For a moment he managed to concentrate on all he could see. The digits on the tracker screen agreed with his own sensations; they were speeding up, slowing down, jerking from side to side—the basket was in fact still being carried by a current, which was weaving its way around things. He should have been able to tell which way and how far, from the tracker readings; should, indeed, have been able to retrace their path if he had had any *control* of their motion. The general direction was indeed obvious; they were heading deeper under the former cliff. How far under was another matter; he didn't remember the position reading when they had gone into the dark, and the succession of numbers which had

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followed that moment had been too complex to memorize.

It was never clear to any of them later how they were able to keep thinking—why the four of them didn't succumb at once to total panic. The Flyers commented later how fortunate it was that all four had had balloon experience, but it was not clear to Barlennan why that should help them with the concept of heavy material *overhead*. He tended to credit his own retention of sanity to his profession. He was a captain, he was responsible, he was used to doing whatever he could that was called for at the moment, and leaving what he couldn't control to luck. This may have corresponded to an almost human personal arrogance. Even so, every little while—he had no way of telling how often—the thought of what he was *under* threatened to crowd his attention away from everything else.

Anything to take that awareness away from him would have helped. He would even have welcomed a theoretical argument from the Flyers. Why all this open space under the cliff, or where the cliff had been? How much mud had there been to wash away, and how had it vanished this quickly so far from the actual river? Or had it? How far did the open space extend? Up and down, probably not very; they were still floating, and it was hard to imagine how the methane surface could have gotten either above the river outside or very far below it. That inspiration caused him to focus on the vertical readings of the tracker for a while; he found that their height was indeed almost constant.

But liquid flows downhill, and this was flowing, so there must be at least a small drop. There might be a big one farther ahead; this didn't seem very good to think of either.

How deep was it? What were their chances of grounding—and staying there in the dark with too much of the world overhead? He thought of trying to find out by swimming, but could imagine no way for a swimmer to find the basket again. He realized later what his failure to think of safety ropes must have implied about his state of mind.

They could call to each other, of course; he tried that.

Multiple echoes responded to his hoots and made sound direction meaningless. In a way this was comforting; Mesklin's stratosphere started only a few hundred meters above the general surface at this latitude. The air, after cooling for a very short distance upward, began to rise in temperature with increasing altitude, so that sounds originating at one spot refracted downward again before going too far. Complex echo patterns from sounds of distant origin were standard, and these gave a slight—very slight—suggestion of clear air above. They actually fooled Karondrasee, who asked, "Captain! It's got to be open above after all! Why is it so dark?"

The captain was quick enough to reply that he didn't know, and almost as quickly inspired to ask, "See if you can think of an answer before the Flyers tell us." That should provide something to distract all the others.

Hars, though, seemed somehow able to think coherently, at least for the moment.

"Captain, shouldn't we do something to secure the instruments? We could run aground any time, though we do seem to be getting carried around things so far, and we don't know how hard we'd strike. The radio isn't any good to us right now, but the tracker might make a lot of difference. If it went overboard I don't see how we'd ever get back out."

"Right. I don't see how we can manage that anyway until the current lets us go, but secure them just the same. The radio will be easy enough; it was made to be fastened to things. The tracker wasn't, though. All of you try to think of a hitch or something to hold it fast."

"Why did they make it ball-shaped?" Even Sherrer sounded more annoyed than afraid. "Didn't they ever think of

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having to keep it from falling overboard?"

Barlennan could think of no useful answer. He had a fairly clear idea of where the rocket had travelled, but no real notion of ballistics. "Salvage all the cordage you can find," was all he said. "Coil it up and stow it around your bodies. Hars, stay with the tracker and hold onto it as well as you can until we solve the tie-down problem. Think of this as a doldrum situation. We do what we can to make use of wind, or current, or an animal we can harpoon to tow us, and hope that one or another of them will happen. Only this time we have a whole new list of things we need to be ready for, and don't know anything on the list."

"Shouldn't we perhaps moor to something, Captain?" asked Sherrer. "The tracker says we're getting farther from the river all the time. The farther we travel, the farther we'll have to go to get back."

"If you can find a way to moor us, I'll agree. Personally I can't see what we're passing."

"Of course we can't see, but we can reach out to feel. Surely some of the broken cliff must be rough enough for a grip!"

"For a grip, maybe. For a rope? Well, reach out and learn what you can." The sailor presumably obeyed, but made no report for a long time.

Nothing particular happened during that time—whether a day or an hour none of them could tell. Cordage was found and secured. Hars contrived a spherical, close-meshed net of some of the finer lines, and enclosed the tracker in this. Without commenting to the captain, he secured it to his own body. Like the rest, he had a strong feeling that this device, if anything, was most likely to get them back to daylight.

Again, Barlennan began wishing for Flyer theories and arguments. He found himself even thinking along Flyer lines. *Why* was there liquid so far under what had been a layer of solid rock hundreds of feet thick? The fact that the rock was no longer solid did not explain where the liquid filling the new space could be coming from. *Why* was there anyplace away from the original river for it to flow *to?* (Item not to think of: liquid flows downhill; where were they being carried?) *Why* had the finer material been washed, or carried somehow, away from the really large fragments of rock, even in here, apparently turning the whole fallen area into a random stack of slabs and columns long enough and wide enough, as it had seemed from their last glimpses outside, to enclose more empty space than rock? *Where* had the fine stuff gone? (Well, downstream, obviously.) Where had the medium-sized stuff gone? (No obvious answer.)

Why did they all seem to be sane in a situation which should have driven any normal person out of his mind? (Or were they? No, Captain, keep away from that thought, too.) They were, after all, experienced and competent members of a dangerous profession, and knew that quite often a dangerous situation offered a good chance of getting something worthwhile out of it. (And of course a better one of not living to enjoy the profit). *That* last thought had been banished from all their minds years before, of course. They were still alive; therefore they were lucky.

Where had the underpinnings of the plateau gone, actually? That was a real Flyer question. And the Flyers were in no position to answer it.

They would want to know the answer, though. And Barlennan and his people were the only ones likely ever to be able to provide one.

That was a thought to bolster sanity. The Flyers always wanted information.

Sherrer was having more trouble. His sounds, when he made any at all, were less and less understandable words and more and more short howls of terror. When words could be made out, they

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were ones that only magnified the fear.

"The world is up there . . . it's heavy . . . it can flatten us . . . what can keep it from falling? We're . . ."

"Quiet!" snapped the captain. "Why should it fall? It hasn't yet, and . . ." his voice trailed off. The stuff above, after all, hadn't had that much time to finish the settling it seemed to have started. It could quite easily be getting ready to fall farther. And it was indeed heavy. There was no way of convincing themselves they were back near the equator, where a healthy person could lift rocks like that. No way, even if they couldn't see. Stop catching Sherrer's fears, Captain . . .

Even if they couldn't see . . .

He jerked out another order; his own mind was recovering, it seemed. "Sherrer, bend a good line around yourself, at least twenty body lengths, and make sure its other end is secure to the basket—to some really strong part of the basket. Then go overboard carefully and try to find how deep it is, and whether there *is* anything we could moor to. Don't leave too much slack; keep most of it coiled against you and stay close to us at first."

"Yes, sir." Barlennan listened anxiously; giving the fellow something to occupy his mind was one thing, putting him where he wouldn't *expect* to see upward might be even better. The information would be useful, of course, but the action *might* keep the fellow from complete panic.

The liquid was quiet; they were moving with it, not through it, and the sound as it slid around the rocks which must be there was hardly audible. The other three could hear as Sherrer measured his line, secured it at both ends, and slipped overboard. Without order, Hars gripped the inboard end of the cord with a holding nipper.

"He's pulling away a bit, Captain; I don't suppose he can see to keep near us. I'll give him a tug or two to let him know." Barlennan didn't bother to answer. "There's some slack, now. What pull there is is smooth; he can't have met anything solid."

Sherrer's voice abruptly sounded, muffled by the methane-air interface but quite audible. The Mesklinite vocal apparatus, a modified part of their ancestors' swimming siphons, worked impressively well in both media. "We're going a little better than walking speed, Captain. I'm on the bottom. It seems to be that slush rather than rock most of the time, though I hit something solid every little while. Shall I try to slow the basket, if I can get a good grip on anything?" The sailor seemed perfectly calm now.

"Try, but not too hard; if you get pulled free by the basket, don't fight it," replied Barlennan.

"Yes, sir. The liquid's getting shallower, I think."

There was no more after that to be said; the sailor had been right about decreasing depth. Moments later, everyone still in the basket recognized the sensation as their craft ran aground on an oozy surface. Instantly the captain snapped further orders. "You two—lines on yourselves and go overside. Get away from here in different directions. Use voice softly to keep yourselves apart—no echoes if you can help it. Find out everything there is around here, out as far as your lines will allow. If there *is* anything we can moor to, report at once and then start doing it."

He was obeyed promptly, and submerged hoots and howls began to echo around the basket. There were, it turned out, plenty of rocks projecting from the ammonia-smelling ooze; some of them barely broke the surface of the methane, many extended upward farther than the sailors could reach. In less than half a day, as well as anyone could guess, they were moored solidly to five different bases, two of them too high to flip a noose over. At least they shouldn't get any farther from the outside.

Getting back to it might be rather different.

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All three of the sailors who had been overboard sounded easier in their minds. The captain wasn't sure whether this could be attributed to lack of upward vision, or just to being occupied; but there was a way to test.

He groped his way to the now cold fire box—cold only in comparison to its working state; the surroundings still felt like the inside of the balloon bag in flight—and felt for the control baffles which had directed the lifting air. These were made of the same fabric as the bag itself, stretched on light wooden frames. Carefully he nipped out a section of the material and deliberately spread it over his head and eyes.

The only obvious difference was that he could no longer see the tracker's characters. He felt no easier about what lay overhead.

But then, that hadn't bothered him, the captain, as much before as he thought it should have. A better subject was needed, though Barlennan had never heard of guinea pigs.

"Sherrer! Come aboard."

"Yes, Captain." If the sailor was uneasy, his voice failed to betray the fact. He came over the side in a few seconds, presumably coiling his safety line as he came.

"Here, sir."

"Can you think of any way back?"

"No, sir. We're—we're underneath—" The voice trembled.

"Don't be ashamed of being scared. It would probably mean something worse if you weren't. Did you feel better while you were working just now?"

"Yes, Captain."

"Feel the piece of sail cloth I'm holding here."

"I have it, sir."

"Put it over your head and eyes, like this." Barlennan helped. "Find some thin line and tie it there. Then go back overboard, and check the bottom all around us for small rocks. I think we can use some—as many as you can find."

Sherrer was neither stupid nor unimaginative, but was not the sort to ask anything like "How?" to an order. He simply obeyed. Barlennan was satisfied. He didn't want rocks, he wanted information, and would have had a hard time in answering a "how" or a "why" just then. The Flyers had not taught him any psychology, but his profession had; and he had grasped certain principles of research—not as well as his mate, but better than vaguely. Sherrer obviously shouldn't know in advance what was expected—or rather, hoped. Let him look for rocks for half a day or so, and then come aboard with them, and give him something else to do with the hood still over his eyes. Something not *too* demanding of his attention—

But how about Barlennan's own attention? Captain or not, there were moments when the tonnage above seemed to fill his mind. There was *nothing* else to think of. Nothing else in the world. Maybe he'd better make another hood for himself.

No. He was the captain, and he knew what was up there. If anyone could ignore it without special help, he should be the one.

Of course, it would be nice if something else were to get his attention away from the World Above.

It was, indeed, a relief when something did.

Jeanette had spent several minutes calling Barlennan after his communicator had gone silent and dark. She had his verbal reports up to that time, and wasn't very hopeful after it; the fadeout hadn't been quite instantaneous. The drifters hadn't hit anything hard and suddenly, up to the time sound and picture had faded. The waves the communicators used were long enough to reach their goal by diffraction even when Toorey was on the far side of the cliff from the *Bree*'s crew, so the basket must have been pretty well *surrounded* by some obstacle within a second or two after that. Barlennan had reported that the methane was flowing into

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openings in the rockfall; she had seen this, as well.

And Jeanette had as clear an idea as any human being possibly could of what being inside a cave or a tunnel at "normal" gravity must mean to a Mesklinite.

She switched to Dondragmer's set at once. He also had heard his captain's messages, delayed barely a second by the round trip to Toorey, and had as clear an idea as the Flyer of what had happened. Some of his sailors had already been ordered downstream to investigate the end of the rockfall; after a moment's thought, he let them go on. He split the remainder into two groups, sending one up toward the point where the eddy had presumably caused all the trouble and keeping the rest with him to get as close as possible as quickly as possible to where he was now pretty sure the original *Bree* was stranded.

The stream had started to widen now as the captain had reported earlier from his upstream position, but the methane at the edge away from the plateau was not uncomfortably warm. Maybe they could reach the ship, or what they hoped was the ship, without getting scalded. The mate told the Flyers what he was doing, and led the way. The river was widening, its edge coming to meet them. The radio remained behind; swimming with it was not an option, and walking on the bottom with it seemed inadvisable. Whoever carried it would be able to talk to the others and report to Toorey, but its viewing equipment would be useless unless it could be held above the surface. It seemed better to learn what could be found out, and then come back for the communicator. No one on the moon was pleased, but no one argued.

The bottom was ordinary ground at first. It had been dry land since long before the *Bree*'s arrival, presumably; the liquid methane was spreading wider and wider past its former bank, and there had been little change in the volume of flow in the thousands of days since their first arrival. There was presumably little change now; the overflow represented liquid displaced from its former bed by rock.

The crew waded for a while, then had to swim, watching where they were headed part of the time but checking below the surface frequently. They were something like halfway to where the ship seemed to be when the bottom began to show lighter in color, and closer examination showed that it was now the same ammonia slush reported earlier by the captain's quartet. It was being washed downstream, they could see at first; then it covered the bottom with a uniform sheet of white, and its motion couln't be seen. Physical contact indicated that it *was* still moving.

The methane was getting deeper, and Dondragmer kept a close eye on what he was now almost certain was the *Bree*. It had been hauled well ashore, but was now out in the stream—or rather, the stream had spread well past it. It would have to be floating soon. Perhaps it was floating now, the mate realized; they were all swimming, and would be carried downstream at the same rate, and the slope across the river was completely hidden by fog, so it was not easy to tell who or what was moving.

It *was* the ship. It *was* afloat. It was easy to reach, fortunately; but it was not merely drifting along with the swimmers. The wind was toward the rockfall here, too, and the *Bree* was being carried very slowly toward the slope as the balloon basket had done.

For just a moment the mate thought of making a sail; then he realized that the wind was toward the rocks and the depth too shallow to lower centerboards and sail effectively across it. With only ten men aboard, rowing would be futile.

Almost futile. Maybe they could keep her away from the rocks long enough to get the radio back aboard—no, they were already leaving that equipment up-

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stream. Dondragmer ordered four of his crew back overboard.

"Get the radio, and start taking it downstream. We're not very far from the end of the rockfall, now; maybe when we get there the heat will ease off and the wind change. If it doesn't, well, the ship's a lot bigger than the balloon basket, and we may be able to paddle it so the rafts catch in a space too narrow to let us through."

The crewmen obeyed. One of those remaining behind raised another point.

"Will the rafts hold together if we catch her across a passage that way?"

"I don't know. Do any extra lashing you can between the outboard rafts before we hit. There aren't enough of us to keep her off, we'll soon be in the fog, and it can't be far from there to the rocks—it seems to be formed by methane hitting them and boiling. I'm surprised the wind doesn't let us see the edge if the fall; the captain could, farther up."

The ship had enough cordage to keep them all busy for the next few minutes. The mate saw his swimming party reach shore and head back upstream to where he could still see the communicator. The downstream party was still in sight as well. The river seemed to be growing even wider there, but its members were staying ashore for faster travel.

The mate had time to think as he lashed. His thoughts rather paralleled the captain's; where did all this methane come from? Unlike Barlennan, he came up with a plausible explanation.

The original river had been fairly deep. If it had been well filled with fallen rock, it would *have* to spread over more ground, or travel faster, or both. But this idea, as the Flyers had often warned was likely to be the case, gave rise to more questions.

If the methane was being displaced by the rocks, why was it flowing *toward* them? There was at the moment no way to ask the customers and, of course, no certainty that they would be able to answer. He would have to do more thinking himself.

And just now there was no time to do that. They were into the fog.

Dondragmer silently berated himself for leaving to chance something he might have controlled. Even the few men now on board could have paddled to turn the cluster of rafts so that its longer side was toward the rocks, and thus improve its chance of catching rather than being swept between rocks and out of daylight and under—

He hadn't been thinking of *under*. Deliberately.

Luck had been with them, as it turned out, but the mate still felt stupid. They didn't touch sidewise, but the starboard bow raft of the cluster hit first on a rock barely above the surface. The after portion swung counterclockwise as the current kept pushing inward. The aft starboard raft struck, harder than anyone liked, on a huge slab which tilted up out of sight in the fog. The midships section continued to push shoreward briefly, but one aspect of the ship's basic design proved its salvation. Ropes stretched, rafts along the starboard side heaved, and the *Bree* came to rest with bow and stern pressed firmly against equally firm rocks and with another fragment of the fall *under* her just forward of amidships. While the rocks stayed there, so would the *Bree*. At the moment, with the darkness farther in easily visible even with the fog, this was a relief...

Dondragmer gave no one time to think. He ordered one of the men overboard with the longest light line aboard.

"Bend this around you. We'll fasten the other end to the ship. Get to the bottom and start shoreward, taking the line with you. Try not to get washed downstream. If you run out of line before you reach shore—you probably will—surface and try to spot landmarks which will let you know where you are and how far downstream we've travelled. Then do your best to keep there and yell for the others. We should still be in hear-

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ing for them. If you make contact, tell them to bring the radio as close to this place as they can."

"All right," the sailor affirmed, "but couldn't someone start calling from where we are? Then they could be looking for me and have the spot marked a lot better when they see me."

"Good. Right. We'll do that. Over with you; they'll still have to see you; they certainly won't see us."

The crewman vanished with no more words.

The line paid out slowly, occasionally going slack for a moment. Dondragmer suspected that the sailor was occasionally losing contact with the bottom, a forgivable offense since the Mesklinite body averaged just barely denser than liquid methane and there was certainly a current. He didn't want to ask, since one of his other men was, in response to orders, hooting as loudly as he could to get the attention of the downstream party. The mate concentrated on keeping track of the length of line paid out.

This eventually reached its end. Rather than have it jerked from his grip and possibly even from the rail to which it had been secured, the mate tightened his own grip and began gently tugging as the end approached. An answering set of tugs came almost at once, and the sailor's voice was audible between the bellows from the *Bree*'s deck.

"Located, sir. I'm only about a hundred lengths or a little more from shore. I'm off the slush, and there's plant stuff here I could tie the line to, but I want to make sure it's solid first."

"Right: Carry on. I'm sure you can hear Felmethes calling. Can you see the others? Can you tell whether they hear him?"

"Can't see them, sir, but I think I can hear them. Can't you?" Dondragmer gestured to Felmethes to be silent for a moment. The fellow had, of course, been pausing to listen for answers at regular intervals, but was glad enough to wait a little longer.

After a few seconds a long roar that seemed like a Mesklinite voice was audible, but no words could be distinguished. The sound ended eventually, and Dondragmer called to Kentherrer at the other end of the line.

"Could you hear that? Could you understand them?"

"Yes, sir. They keep asking if it's you, and say they can't understand you. There must be something about echoes along the rock faces."

"Could be. See if you can make them understand *you*. If so, tell them what's happened, and have them come back here."

A perfectly comprehensible pattern of hoots in Kentherrer's voice was the response; evidently he was more or less in touch with the other party but having trouble with clear communication. Dondragmer was patient. He was not exactly worried about the captain; there was very little hope that he and his fellows were alive, and rather less that they were sane. It was better not to rush into anything until there was at least a vague idea of where to rush.

Besides, it was not likely that anything at all could be done about the missing balloonists until the *Bree* could be brought ashore and rigged again. Even then, it was far from clear just *what* could be done. The most obvious technique, searching among and under the fallen rocks, was unpromising even if there were some way of telling where to start the search.

Come to think of it, there was a way for that. Barlennan had described in a good deal of detail the area downstream from the point where the eddy started. The point should still be there, and maybe even the eddy. If necessary, they could leave the ship where she was and search as a climbing or a swimming party.

Under the rocks? Well, maybe.

Kentherrer's voice had faded, but could still just barely be heard. The party must be coming back. It seemed to the mate better to wait until they arrived,

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rather than attempt a three-cornered conversation thorugh the echoes.

He felt just a little foolish when Felmethes went overboard and began talking in an ordinary voice, submerged, first to Kentherrer and then, only a little louder, to the downstream party. He hadn't heard, or at least distinguished, the message from the latter saying that they were going to submerge; but that, by his standards, was no excuse for not remembering that words could be made out much farther in methane than in air.

He had had no experience with complex echoes under the surface, and it would be a long time before he knew about the speed/wavelength relation and such phenomena as diffraction, but Dondragmer went overboard anyway, and listened to the conversation for a moment. The downstream party was indeed on the way back. He joined in loudly.

The group had made out and acknowledged his order to get the communicator. Then another pattern of hoots, as blurred and devoid of meaning as the first sounds in air along the rocks, interfered with the conversation.

Words were indistinguishable. So were individual voice patterns. But the one other party under Dondragmer's orders *should* be on land, and a quick flow to the *Bree*'s deck and back into the methane—Mesklinite hearing was not confined to any one part of the body surface—made it obvious that this noise too was originating in liquid. The same body of liquid which was flowing along the face of the rockfall.

And into it. The sound must be coming from the captain's group. At least one of them was alive.

Barlennan could make out neither words nor individual voices either, but the leading fringe of the noise pattern, before the echoes ruined its structure, left him no doubt that it was a *voice*. He didn't have to think. Words or no words, if he could hear the speakers, they should be able to hear him. If they heard him, they would know he was still alive. If they knew he was alive, they wouldn't give up on him and his party. He and his men were as good as rescued.

Except, of course, for minor factors such as how anyone could find them in this lightless maze where sounds came from all possible directions at once, that they had practically no food with them, and were in about the last place on Mesklin where anything edible could be expected to turn up unless it were washed in from outside.

Come to think of it, why shouldn't food wash in from outside? There were plenty of fish in the river, and the current was coming from that direction. Why were they lying here hungry instead of fishing? Well, they couldn't see, of course, and you can't hear fish—but it was something to think about. Hard. He ordered his men to think about it, and went back to the basic problem.

Barlennan's group knew, in a sense, where they were; the inertial tracker was readable. But there was no way to get its readings to anyone else; if the radio was blocked as it seemed to be, the tracker's signals to Toorey must be equally unreadable to the Flyers. The echoes in the maze ruined any high-volume talking even if Dondragmer knew he was alive, and what else could lead rescuers close enough for quiet, echo-free talk? The captain could think of nothing. Could the mate, or the Flyers?

Jeanette didn't need to relay Dondragmer's report to the other Flyers; enough people were already with her in the com room. The relief that the captain might still be alive and sane—however garbled, the sound had been brief and seemingly better then raving—was tempered by the same doubts that Barlennan himself felt. Could that noise source be found? Could Mesklinites deliberately search, personally or otherwise, the maze under the rockfall? How long could the captain and his people live

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and remain sane to be rescued? On a more cold-blooded level, could the tracker be salvaged if he didn't?

The Drommian who voiced this question had the grace to show embarrassment, but even the human and other beings present couldn't dismiss the thought completely from their minds. There were still Mesklinites at work salvaging the rocket contents, but there were no more trackers.

Dondragmer thought of that aspect very fleetingly, and only to wonder about and dismiss at once the chance of using the tracker somehow to find its holders. It seemed far more practical to examine the area where the basket had disappeared. There might be meaningful clues among the rocks.

He left a watch of four men on the *Bree*, and with everyone else not at the rocket set out upstream, carrying the radio. Some of the group had been sent that way earlier, and the rest did not catch up with them until reaching the point level with the eddy, days later. From this position they could see much farther upstream, and the balloon bag which had been caught and separated from the basket was easily visible. The mate sent half a dozen sailors to salvage it, and with the rest took to the river, swimming across below the eddy and spreading along the foot of the tumbled fragments to look for other traces.

There didn't seem to be any. If the basket had brushed against anything on the way inside, either nothing had scraped off or, if it had, had vanished down river. The loudest possible hoot in air brought no response from the rocks, but when it was repeated from below the surface it was answered at once, more loudly than before. Several of the sailors muttered satisfaction; but all fell silent when they saw the mate looking thoughtfully into the widest of the gaps where methane was still flowing in.

The eddy seemed as strong as the captain had reported. He had said nothing about the speed of flow into the rocks, but all could see that it was faster than anyone could be expected to paddle anything. It didn't seem faster than a person could swim, but if one were too far inside to see daylight there would be no way of knowing which way to swim.

"They're in there somewhere," the mate said slowly. No one disagreed; no one said anything.

"Kentherrer, use a safety line and check how deep it is here. *Don't* go inside. Three of you, hold his line." He paused until Kentherrer was submerged. "Tell me if you have any trouble holding on," he added. He did not specify whether this meant to the rope or to the rock, and the sailors didn't ask.

The line was paid out for about four body lengths before it went slack. It was not pointing straight down; the swimmer had been carried a short distance into the cleft by the current, but seemed calm enough when he reappeared.

"The bottom hasn't any of that slush," he reported. "It seems to be sort of gravel. I suppose really fine stuff would be carried inside."

"Could you get good footing on it?" Dondragmer asked.

"Not—not very good, sir."

The mate and the crew knew each other's thoughts perfectly well. The former made some allowances for the objectivity of Kentherrer's report.

"We'd probably be safe enough, if we roped together. If anyone lost grip on the bottom, the others could hold him until he got it back. I don't—see—anything to do but—go in and search."

"Under all that?" one of the men asked before he could control himself. Dondragmer was silent for perhaps a minute. He was reasonably sure they would follow him if he went first, but wasn't quite sure he could lead. Not there.

"You may have something," he said at last. "*Under* it, in the dark, there'd be no way to tell where we were going or where we'd searched already. But *over* it—"

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By ordinary Mesklinite standards, *over* was little better than under. One could fall, of course, with a couple of hundred times Rim weight. But this was the *Bree*'s crew, who had been getting used to *up* and *over* in various ways for somewthing like a hundred thousand days now. *Over* just wasn't as bad.

One of the sailors was sent back to the radio to tell the Flyers what the mate had in mind, and to relay any later messages. In another couple of days the mate and his remaining men were linked in a network of cordage, no one closer than eight body lengths to any other, and no one connected to others by less than four separate safety lines. The climbing was clearly not going to be easy or quick, but it would be as safe as the mate could arrange.

Mesklinite legs are extremely short and their feet are not adapted for climbing, but they grip well on any reasonably rough surface. They have evolved for low as well as high gravity, and in the low-gravity latitudes there is always the risk of being blown away.

These rocks were rough in most places. The joints along which they had separated in the recent fall were not, for the most part, slickensides. Travel over them was fairly easy, except for the distraction of looking down so much of the time. Not even the sailors were totally immune to that fear.

The rope spiderweb began to flow up and over the fallen slabs. Once all were away from the methane, Dondragmer ordered them to clamber horizontally upstream to the point where the eddy current went straightest into the maze. This served two purposes; it made it likely that they were upstream from wherever the captain might be, and could search downstream with reasonable certainty of passing him—whether they knew it or not. Also, it gave some practice in climbing before getting too far *up*.

It even gave some practice in falling. Twice one of the sailers lost his grip and found himself hanging from a set of ropes. Both times a hoot of alarm was cut off sharply as the faller realized he was being supported, and managed to control his emotion with his intelligence. Most encouraging of all, neither time did anyone on the other end of the ropes lose his grip.

So they started uphill. The rocks were noticeably cooler now. Even with the fog, there was little trouble keeping direction. Each time the web had moved about twice its own width the climbers paused and called loudly. After some days, they reached the top of the slope and were against vertical rock again; they moved a couple of web diameters downstream, and started down again.

Every few days they called across the river to report their lack of result to the Flyers. They could make out the voice of the sailor on watch there clearly enough, but he had trouble untangling their words from the echoes. The messages, however, were simple enough—"Nothing yet" as a rule—and there was no real confusion.

Back at the bottom, still fastened together, they swam back across to the radio, reported in more detail, then rested and went hunting and fishing. Fed as well, they returned to the up-and-down coverage of the fall.

Every so often, an undermethane call was made; it was always answered by a sailor at the methane's edge. Dondragmer wondered more and more seriously as the days went on what the lost group was doing for food. He was even slower than the captain in thinking of possible fish, but when he did, was much faster in realizing the problems of fishing in the dark. There had been very little food on the balloon, and it had been many days, now.

It was on the food question on which Barlennan decided to take some action of his own. Fish either weren't around or were able to sense groping chelae, and there had been no fishhooks aboard the balloon. He realized that any infor-

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mation the others might have about his location would be invalidated if they left it, but being found dead of starvation seemed a more serious risk. Besides, he could see no way of the crew's having any such information. He had also realized that there should be no trouble in deciding which way to go, if they went; not only did the tracker provide a clue, but the current was still flowing past them, apparently unchanged. If they could travel against it, they should sooner or later reach the river.

Unfortunately, while it was not flowing nearly as fast as any of them could swim, it was just in the wrong direction, and their own personal strength was failing—not seriously yet, because they'd been simply lying in the basket and occasionally answering what were presumably the mate's calls, but swimming against a current . . .

Even *crawling* against a current . . .

Crawling would be better, if they could keep hold of the bottom. Better still, if they could anchor themselves to the bottom. The radio and the tracker would help with that, and should be brought along in any case. A few rocks would hold the basket down; but they couldn't drag the whole basket against the current, whether it were ballasted or not.

So they'd salvage material from the basket and, as well as they could in the dark, make a container to carry a few rocks. It might not work out; basket-weaving in the dark did not promise well; but it was better than starving passively.

He told the others what they were going to do.

A deafening roar, accompanied by a trembling of the rock on which the basket lay, suggested that he had the right idea.

The same roar was heard by the others, even those at the rocket over a dozen miles away. The search web was headed downward on its fourth round trip. Each of its members felt the same quivering under his feet, and froze in position, looking wildly in every direction. The Flyers heard, but of course felt nothing.

The sailor at the radio came closest to seeing; he could tell by the sound direction that the disturbance was somewhere upriver, even with the rumbling echoes that followed it, but there was still fog in that direction.

No one, even Barlennan with the most restricted sight, had the least doubt that rocks were settling still. The Flyers wondered why; the Mesklinites, where. Neither could even guess at an answer, but the natives could, and did, hope. The operative fact was that if anyone could do anything whatever, it needed to be soon.

There was no way that Dondragmer's efforts could be speeded significantly; trying to climb around faster, it quickly became obvious, simply increased the time lost retrieving dangling climbers. The Flyers had already launched an observation craft to get better pictures and maps of the locale, but days would be needed to obtain those, probably more days to get any pattern for the continuing settling of the rockfall, and no obvious reason to believe that the information would really be useful to anyone but abstract researchers.

But Barlennan could do *something*. Motion in the right direction, however slow, was better than staying where they were, and they did know the right direction. Upcurrent.

But they were already somewhat weakened by hunger. In a sense, they had some food; Karondrasee's juice tank was perhaps half full. Unfortunately, the juice had been selected for its catalytic properties, as observed by the cook, on the plant tissue used for lifting fires, not for its caloric content. It was also most repulsive to taste—the cook knew that; he had distinguished his various trial samples by that sense, since he had no other laboratory facilities. Even the Flyers had admitted that there was little

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choice, though the alien chemists had expressed the very lowest opinions of that analytical technique.

The tank, however, would be enough denser than methane to help hold them onto the bottom, provided they replaced the air now partly filling it with liquid. There seemed at the moment nothing to be lost by diluting the juice and bringing the load along.

Discussion was brief. All three of the crewmen could see the situation as clearly as their captain, and it was not just a matter of obeying orders.

All four of them were now wearing the improvised hoods; even Barlennan had decided that it made things a *little* easier not to expect to see, and as long as the current flowed there was no real need to consult the tracker. There was no way of knowing just when the four of them submerged with radio, tracker, small basket of rocks, and juice tank with its top valve open, but it was long enough for one more roar of settling rock. Barlennan was actually delayed by this; he was slightly afraid that his men would be tempted into unwise haste, and insisted on a final recheck of every knot, both in the lines holding the equipment and those linking the travellers together. This delay did put a slight strain on discipline.

Progress was slow. Even with the extra weight, traction was poor. The tank proved to be the least effective ballast and Karondrasee, who was carrying it, was frequently lifted from the bottom, and whenever this happened his next in line, Hars—cook and tank were last—had to find something to hold onto himself. Sometimes there was nothing in reach, and they would lose in a few seconds several times as much distance as they had gained in the preceding few.

And they were getting hungrier, and more tired. None knew how much time passed. Every little while they would bellow to let others know they were still alive. They always heard answers, but there was no way of being sure whether these were coming more quickly or not. It would have been very encouraging if they had been.

Travel did get easier after a dozen or more reports, but for a slightly discouraging reason.

The current was losing its force. There was a perfectly plausible explanation: the space behind them, whatever it was, where the methane had been going was at last being filled up. Barlennan had been learning, however; he told himself firmly that there *might* be other explanations. He put the question before the others, more as a distraction than in hope of alternatives. He got none, but distractions were still useful even with the hoods; there was still a lot, no one could guess how much, of Mesklin overhead.

It was also getting somewhat cooler, they could feel, though the slush underfoot was still slush and still provided very poor traction.

And they were getting hungrier all the time. That in itself made travel more and more difficult. Chemically, evolution in an energy-demanding environment had given them the equivalent of a very large human glycogen reservoir for their size, but even that had its limits. They were nearing those limits.

The juice tank was now very dilute; they had not bothered to close the valve. This made the taste more bearable when they finally gave up and tried it. However, there is little to be gained by adding more catalyst, even just the right catalyst which this was not, when the supply of reactant is nearly gone. No one felt any less hungry than before, and the cook/flight engineer, whose digestive equipment might have been affected by his earlier experiments, was extremely uncomfortable for a time. He was quite unable to crawl or swim, and the party had to wait where it was.

Another roar and shudder of settling rocks enabled him to find some strength, and they moved on. The current was nearly gone, and they were

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guided now by the tracker, much more slowly even than before. The captain made the next report hoot by himself, hoping that its relative weakness would give the listeners a suggestion of their plight.

It didn't work; the sailor on watch below the surface who had been doing the answering didn't notice the difference. There was a good reason for this, it was realized later. The captain was now much closer to the searchers. However, the rumbling echoes of his voice still lasted about as long as ever and hid the volume difference. He himself failed to notice any change in the answer; he blamed it later on the distraction caused by hunger.

Hars, more than any of the others, hated to feel his energy going. He also hated to fail, and he still felt responsible for the tracker he was carrying. He probably had the least idea of any of the four why the echo problem should be less in air than in methane, but he had reached a point where anything seemed worth trying.

They had done all their calling under-methane, for obvious reasons; sound travelled better there, as everyone knew. On the other hand, one grew tired more quickly there, though Hars didn't know why. One was lighter below the surface, obviously, but for some reason had more endurance above. "Hydrogen concentration" was not even words to him. But if there was anything to climb out on, he knew he would feel better.

He began to mutter aloud. Just mutter. He would have done something else if he had been leading, but the captain was in front. The others could hear. of course, and Barlennan began to worry. Sherrer's lack of balance had been serious enough; Hars was by far the most powerful of the group, even now. If he were to panic, it might make the final difference. Especially with them roped together. After a little thought, he spoke to the sailor.

"Hars, what's the matter?"

The pilot was actually embarrassed. "Well, Captain, I was wondering whether we could find a slope and get up in air for a little while. We could do with some rest, and it would be better than under methane. I didn't realize I was thinking out loud."

Barlennan thought quickly. Shortage of air—hydrogen—at this point was not actually as serious as shortage of food, but it was certainly much more uncomfortable. It didn't much matter where they were if one of the rock settlings took place near them. They were as likely to be found in one place as another, after all; and if they really couldn't get out from under—

"All right. Change the setup. Hars and I will travel side by side, a rope length apart. Sherrer will be at my right, Karondrasee at Hars' left. It will be harder to keep the line straight, but we'll be more likely to find an upslope."

It took some time to rearrange the safety lines, but they were slightly rested when it was done and they were advancing in the new formation. It was harder to travel, however, since they could not be as much help to each other. Even the captain was ready to call a halt where they were when the rope connecting Karondrasee and Hars dragged on the bottom.

There was some sort of bulge. Hope of a sort began to rise as they examined it and found a continuing slope. A solid one, of rock. The hope was mostly for comfort, not rescue, but the comfort was that of fresh air. They crowded together and began to creep upward. The slope was very shallow, and not difficult to climb even in their conditions; and for a while all feared that it might not reach the surface.

Fortunately. All but Hars had to stop for rest before they reached surface. With the four huddled together to rest, there was enough slack to let the pilot crawl a little ahead of the others, and in less than five body lengths he broke the surface.

With his encouragement and help,

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the other three also emerged into air, and relaxed gratefully.

Nearly starved, they were really in no state for rest to do them much good, but they could still enjoy the sensation. Even Barlennan waited much longer than he should have before issuing the order to go on. His mind and conscience argued against giving up, but he knew that more time in air would not really help. Another rock shudder emphasized this, but still he hesitated. Lying still felt so good—

So he had not yet spoken, and not yet decided to, when airborne sounds reached them.

Voices. Not really understandable yet, but obviously broken up into words this time. The four hooted in unison, reflexively. Shorter wavelengths don't diffract so badly, and sound waves are *much* shorter in air.

The only real question then was whether Dondragmer's people would climb down or Barlennan's climb up, and that was easy to settle.

The distance wasn't great; the mate's party could see how close they were to river level, but the captain's group lacked the needed strength. The members of the net above were out in daylight, able to look down at the spaces below, where they would descend into unknowable *depths*. Well, not really unknowable; the captain and the others obviously weren't *very* far down, but the word was *down*. But the rescuers could climb down.

The mate, still attached to four safety lines, descended with food, and after half a dozen false turns managed to deliver it. Then, one at a time, rested and fed, each with three lines firmly attached to him, the balloonists were partly hauled and partly climbed up to the web. A sailor brought the lines back down for the next rescue, and another one for the next, and when one descended for the last time, he and Barlennan used two ropes apiece to get back to daylight.

There had been some debate about the communicator and the tracker.

The former had been hauled up ahead of the captain on a pair of carefully fastened lines, but the inertial equipment had gone up even earlier, still fastened to Hars. It remained attached to him until everyone had crossed the river to the other communicator; he refused to abandon the duty until the whole group, except the ones still at the rocket, was together.

The Flyers understood, they thought. They certainly didn't complain. All Barlennan could overhear and understand was another of their theoretical arguments.

"Look, there's only one explanation. We know that rock is sedimentary—"

"Know?"

"Well, it's pretty obvious. One of the layers of the plateau, just below the foot of the cliff, has to be ammonia. That's mineral there. A lot of it was melted by the falling rock, and the Mesklinites smelled it—"

"Smelled something like it."

"What else could that be?"

"How do I know? I'm not a Mesklinite."

A third voice cut in. "The two of you are just gabbling. We haven't seen a layer that looked like ammonia—it'd be white, like ice."

"It *would* be ice."

"All right, but we haven't seen any."

"It's underground at river level."

"But how could—?"

"That's what I'm saying! We've got to check—I mean, Barlennan's people have to check—"

"How? They don't have drills, or shovels, or picks, and you can't expect a Mesklinite to go tunneling, do you?"

The captain had never heard this verb, but context suggested its meaning, rather too clearly.

"Why not? Barlennan's had lots of time underground now, and he's still all right."

"How do you know he is?"

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The captain started to tune out, as usual. Just another of the theory-based wrangles among Flyers, which of course *might* lead to something later.

Then he saw what the something probably would be. The Flyers were very persuasive beings—

Any being with muscles and a nervous system complex enough to consider alternatives consciously can shudder. Dondragmer was obviously listening, too.■

Addendum To Whirligig World

When *Mission Of Gravity* was finished in late 1952, I had a perfectly honest degree in astronomy. I nevertheless made a few mistakes, including one in basic physics; I said, somewhere in the story, that the *Bree* would sail faster with the wind behind her. Predictably, a sailor caught that one.

More seriously, I erroneously took for granted that the figure of rotation which was Mesklin would be an oblate spheroid, and did all the gravity calculation (on a slide rule) assuming that most of its mass was degenerate matter very close to the center. John Campbell told me when he accepted the story that a mathematician had told him that Euler must be spinning in his grave, but I still don't know what theorem I violated.

More usefully, a few years after the story was published, members of the M. I. T. Science Fiction Society (MITSFS) managed to get enough computer time to figure out more nearly what the planet's shape would be. They were presumably right; all I could console myself with was the realization that I had written the story to give pleasure to people even if that wasn't quite the specific pleasure I'd had in mind.

I eventually did get a computer, wrote a relevant program in BASIC and came up with an object looking more like the discus used in field and track sports—an object fairly sharply curved at the poles, much flatter in the mid-latitudes, and coming almost to a real edge at the equator. With arbitrarily chosen three *g*s at the equator, the polar gravity came out to only about 275, as I recall.

I assume that readers with appropriate background knowledge and computer hardware will want to check this. Maybe someone will want to write a book on the things that minor differences in the basic assumptions will do to Mesklin's shape.

Personally, I wound up doing forty years of high school teaching instead of being an astronomer essentially because of my mathematical weaknesses.

Hal Clement
Milton, MA
March 1999

(EDITOR'S NOTE: Earlier Astounding/Analog *stories of Mesklin and Barlennan include* Mission of Gravity *[April-July 1953] and* Star Light *[June-September 1970].)*

Conformity is the jailer of freedom and the enemy of growth.

— John F. Kennedy

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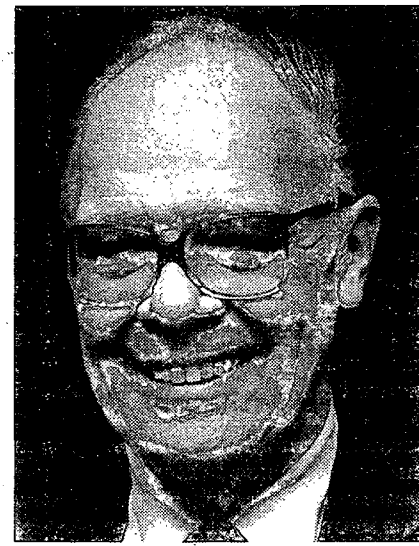
BIOLOG Jay Kay Klein

Harry Clement Stubbs made a name for himself in this magazine starting with the June 1942 issue: Hal Clement. Three years into the Golden Age of SF, he became not just part of it, but its foremost hard-science exemplar. "Proof" shared the issue with one of the early Foundation stories, the cover story. Later, Hal was to have many covers of his own. That first story is filled with references to flying, but was set in space like his childhood favorite Buck Rogers. He was soon to become a WWII bomber pilot. On thirty-five missions for the Eighth Air Force, thousands of split-second perils resolved in his favor to let him get safely through the war to create SF masterpieces. His most terrifying mission was flying below sea level over Holland where his huge plane brushed tree tops.

Editor John Campbell was glad to receive seven wartime stories when most other contributors had stopped writing completely.

Hal has a habit of meticulously getting the sciences correct, but sometimes that leads to his stories being betrayed after the fact by new scientific discoveries. It used to be thought that Mercury and Venus were locked tidally to the sun. Now, it is known they're resonance-locked to the nearby planets and rotate slowly. Space stories were a mainstay of this magazine and Hal received a B.S. in astronomy from Harvard in 1943. Into the WWII meatgrinder he went, winning pilot's wings early in 1944. Later, recalled in 1951 for the Korean War, he spent two more years first as a squadron exec, then a tech instructor. By the time of his retirement from the reserve in 1976, he had reached full colonel.



Hal Clement

A lifetime resident of the greater Boston area, he came back after WWII determined to settle into a nice, normal, safe occupation. Boston University granted him an M.A. in education in 1947. An M.S. in chemistry came seventeen years later. He taught public school for two years, then was science teacher for thirty-eight years at the private Milton Academy in Milton, MA. People wistfully talking about getting better school teachers could never find someone with Hal's credentials. The headmaster was glad he used a nom de plume since back then SF wasn't quite respectable. Hal made science interesting and fun for the boys. Practical demonstrations caught their attention,

(Continued on page 186)

Photo by Jay Kay Klein

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John D. Trudel

THE PATENT WARS

The most important developments in technology are not necessarily technological—or beneficial.

Punctuated Equilibrium

Are you familiar with what scientists term "punctuated equilibrium"? The notion is that species, ecologies, and societies go through long periods where little changes, and then suddenly—bang!—there is a disruption that restructures the world. I'm convinced that this is happening now, and that the focal point is centered on business and economics.

Books are being written about this. My own, with Dr. Gerardo Ungson, is called *Engines of Prosperity.* The preface noted "There has never been any time in history when the human race has faced so much change." [1]

It is, paradoxically, both the best and worst of times. "Opportunity abounds, but the economic, societal, and technological foundations of the Machine Age are crumbling." Our core premise is that "Anything that is standard and routine very quickly falls to third-world wages and razor-thin margins."

Ironically, Western Machine Age business was not at all about innovation. The Machine Age was typified by a culture of competition based on bulk processing and adequate products. Production tended to be repetitive, much the same from day to day or year to year. Competing meant keeping product flowing, keeping costs down, and trying to improve quality. Since career advancement came from not being blamed for mistakes, new things were best avoided. New things, however promising, are so easily criticized.

There is an art to that sort of management, one discussed by decades of literature. It favors an environment free of surprises or glitches, one characterized by control and planning, one where customers have limited choices. It favors a hierarchy of workers and bosses. Machine Age workers should be, in the words of early efficiency expert Frederick W. Taylor, "no smarter than an ox." Because bulk processing is repetitive, it

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allows constant improvement. And so, this was a world that favored internal focus, hierarchy, planning, standard procedure, and controls. Above all, it was a world of optimization.[2]

Though strategies vary, most agree that the twenty-first century demarcates a post-industrial or knowledge-based society, one where the fundamental sources of wealth will be knowledge and communication rather than natural resources and physical labor.[3] In such an age, where capital and production capacity are globally abundant, the traditional "endowed factors" of classical economics are increasingly unimportant.

Today's high-margin products are made from knowledge. Everything else drops out of the equation in today's global markets. Products built from unique knowledge are gold mines, as firms like Microsoft and Intel and Sony and Toyota have learned.

Our trading partners are more aware of this than most U.S. companies. Japan's Fumio Kodama reports that their manufacturing firms, since 1985, spend more (now about 80% more!) on R&D than they do on capital equipment.[4] As we said in our book, "Where nations once fought wars over trade routes and natural resources, future conflicts will be over the ability to produce and market uniquely valuable products."

Engines of Prosperity discusses these things at some length. However, the purpose of this article is not to sell books. It is to alert those who care about technology and our nation's future of a new arena of international conflict that may shape our future. The Cold War era has been replaced by international trade conflict, and is moving toward what I call "patent war."

Back to our roots

Ironically, we started all this back in 1776. It turns out that during the founding of the United States our ancestors invented the notion of patents. Most of the history we now read focuses on the small band of revolutionaries with rags on their feet who defeated the strongest army in the world. Most of the rest discusses the emergence of a new form of society. The concept of a system where power came from the people—government of the people, by the people, and for the people—defied all precedent.

Less reported is that the same events saw a rebirth of technology and led directly to creation of the Machine Age and the products that now surround us. As a new nation, our focus was on the future.

Our founders were convinced that the crown jewels of the new nation were not what we had, but what the hands and minds of our people could create. The right of citizens to own intellectual property in the "arts and sciences" was the first right awarded to citizens. Even before the Bill of Rights, our citizens' right to profit from innovation was assured by Article One, Section Eight of the Constitution.

Our patent system, unprecedented and unique in the world, was central to the new Republic. The first patent commission was a collection of our best leaders, the finest minds of the time. The first patent commissioner was Ben Franklin. George Washington himself was the CEO, and signed every patent. The commission included the Secretary of War, the Secretary of State, and the Attorney General.

The notion of intellectual property ownership by citizens was unprecedented. Inventors were guaranteed a limited monopoly in return for providing society with a detailed cookbook of how to replicate their inventions. As the years passed, many fortunes were made. People from all over the world flocked to the U.S. to seek opportunity. We deemed the right to own knowledge crucial, and even our enemies agreed.

In 1814, during the War of 1812, Washington, D.C., was burned by the

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British. The patent commissioner of the time heard of the invasion, got on his horse and galloped into the city. When the foreign troops arrived, he was standing on the steps of the patent office. "Please don't burn this building," he said. "This is the patent office. It contains your future as well as our own." The British officer heeded him, and that was the only building they spared.

If we define innovation as the development of technology for commercial gain, we invented it. So said Abe Lincoln, a patent-holder himself: "(It) began in this country, with the adoption of our Constitution. Before then, any man might instantly use what another had invented; so the inventor had no special advantage from his own invention. The patent system changed this; secured to the inventor, for a limited time, the exclusive use of his invention and thereby added the fuel of interest to the fire of genius, in the discovery and production of new and useful things."

Innovation, like liberty, has always been an American core value. President Benjamin Harrison said so at the Centennial of the U.S. patent system: "It distinctly marked, I think, a great step in the progress of civilization when the law took notice of property in the fruit of the mind."

Over time, many technological miracles were created, adopted, and became commonplace—automobiles, washing machines, telephones, aircraft, computers, and on and on and on. Of late, others have done better at business and at commercializing our inventions, but our unique system, rooted in individual rights and property of the mind, has produced most of the innovation in the world.

Intellectual property today accounts for well over 50% of American exports and 99% of our manufacturing base. The United States remains a major player in the world community because we have the largest body of intellectual property in the world.

Uniqueness can be a virtue

The United States Patent System is still unique in the world. Its concept was brilliant. In exchange for fully disclosing his inventions, an innovator would be awarded a limited monopoly so that he might prosper and profit. After 17 years, the invention would fall into the public domain. Some six million patents are now in the public domain, shared by all to benefit mankind.

It is undisputed that this unique combining of self-interest and public good encourages invention. Ours is generally agreed to be the best patent system. Some claim it has spawned 95% of the innovation in the world. In today's new, global, knowledge-based economy, we stand on the brink of a new golden age of prosperity.

Still, the nature of technology is disruptive, and it is no coincidence that most patent systems have a different purpose than ours. Most protect vested interests by spreading inventions around to benefit existing firms. Japan's system is so designed.

While our system encourages innovation and rewards inventors, theirs distributes technology for the benefit of the *keiretsu** firms.[5] It was put in place at the end of World War II and helped rebuild their industrial base. Though this approach may stifle innovation, it creates, as our Japanese friends say, less "confusion."

Japan's inability to innovate has created increasing problems for their society. They would like the high-wage jobs and high-margin industries to be theirs.

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* Definition: A *keiretsu* is "a large interlinked set of complementary firms providing mutual support, usually ordered around a bank." For example, Sumitomo Bank's *keiretsu* covers six market groups (trading and metals; construction, cement & glass; real estate and mining; chemicals and forestry; finance and insurance; electrical & electronics). These firms are huge. The last grouping, for example, includes NEC and all its key suppliers.

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That's sensible. How can you blame them for that?

Japan implements superbly, but invention is a challenge for them. Their society stresses conformity. It has slogans like, "The nail that stands up is the one that gets hammered."

In 1991 a very smart Japanese (one at their top levels of trade policy setting), Fumio Kodama, published a book saying the key to continued growth in Japan's economy was to take a new view of technology. He said that wealth accrues to those who apply technology, not to those who create it.[6] He was correct, and his work was well received.

Kodama's book won the prestigious *Sakuzo Yoshina* prize for the best book in the social sciences, the first time in hundreds of years that an engineer had ever won this award. One of Kodama's themes was "technology fusion," the idea that firms should search the world, borrow technology, and blend it together to make unique, high-value products. His idea works.

Still, Kodama's strategy led to problems. Sometimes those whose technology was "borrowed" objected. Sometimes they sued, and U.S. patent law, when enforced, is formidable.

As a result, in 1993 Japan's Ministry of Trade, MITI, published a white paper saying that the U.S. patent system was "unacceptable." That's pretty bold: Our Constitutional right is "unacceptable!" The Japanese see our patent system (correctly) as a major barrier to accomplishing their economic objectives.

In the end, our Commerce Department signed letters of agreement with Japan in 1994. The signatories were Ron Brown, then the Secretary of Commerce, and Bruce Lehman, then the Patent Commissioner and Deputy Secretary of Commerce. These letters, if implemented, effectively convert our patent system into Japan's.[7] To me, that is good for Asia—an economic surge from cheap access to our technology—but bad for us.

I stumbled on this agreement by accident and at first I could not believe it. The PTO (Patent and Trademark Office) official who told me the story likened the meeting to "the World War II surrender on the U.S.S. Missouri." He said the Japanese delegates in the meeting were calling Tokyo on their cellular phones, gleefully reporting, "The U.S. has given us their patent system."

I told my source that if he could find proof, I would write about it. His proof was one easily dismissed incidental note in the voluminous 1994 report of the Commerce Department to Congress. My resulting column was titled "The Great Patent Sell-Out"[8] (which describes and discusses the note's content). It ran in the November 1995 issue of *Upside*, a Silicon Valley magazine. The letters of agreement, now posted on the Web, are admitted, but they have been strangely absent from Congressional debate.

Fortunately, the agreements can't take effect until Congress passes laws to enable them. Largely unnoticed by the media, such legislation has been repeatedly introduced in Congress. Much effort has gone into ensuring that the proposed changes will get little attention and be irreversible.

Usually the bills are introduced just before a recess or appended to key pieces of other legislation. For example, the one change to the patent system that has slipped through was a reduction in term. That change was one paragraph in the multi-hundred-page GATT treaty, which was "fast-tracked" and rushed through.

So why change our patent system, if it works so well?

One needs a good reason to propose changing something that has worked so well. It has to be simple and easy to explain to Congress. It has to be plausible. It should fit into a sound bite, and be at least factual enough that the responses are "Yes, but. . . ."

Lehman's solution was to report a

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"problem" to Congress, one that he called "submarine patents." His notion is that unscrupulous small inventors "game the system" by deliberately delaying their patents. These lurk like a submarine hidden under the surface. Then they torpedo large firms, costing them millions of dollars through abusive lawsuits.

Lehman's submarine patent argument keys on *intent*. If the post office takes a long time to deliver a letter, do you blame the sender? If a patent takes a long time to issue, do you blame the inventor, who is not getting any income and is watching his term expire? (Patent term was changed to 20 years after filing in 1994.)

Lehman's submarine patent argument effectively said that you should blame the inventor if his patent took a long time to process and still made money. This is cruel logic, which, if accepted, strips the inventor of not just one, but several, Constitutional rights. He loses his right to be presumed innocent until proven guilty, and as an unscrupulous submariner, he loses his right to own property of the mind.

If they exist, Lehman's submariners are most elusive. Of 2,300,000 patents issued from 1971-1993, there were some 627, 0.0013%, that did not issue in 20 years. Of these, 500-600 were due to some type of government secrecy order. Of the rest, only one was valuable. Lehman said it was a submarine, so that patent is notorious. See *http://www.heckel.org/congress/104cong/articles104/bansub.htm* for more information.

The single exception was a patent on robotics vision by Jerome H. Lemelson. It took 40 years to issue. The 1950s patent office had a problem understanding his concept. It made him split it into several separate patents. He spent most of his life refiling and waiting. See *http://www.alliance-dc.org/aainews/jerome.html* for the details.

Lemelson was not your typical inventor. With some 500 patents he ranks with Edison and Land as one of the greatest of all time, and perhaps the last of a breed. His ordeal is well documented. Most inventors see him as the victim, not the cause, of bureaucratic delays.[9]

Lemelson persevered and finally got his patent. It cost those who infringed, initially the Japanese auto companies, tens of millions of dollars.

Had Commissioner Lehman found a submarine patent? I doubt it, but the answer depends on what you assume Lemelson's *intent* was back in 1954 when he first filed his patent. In any case, is something unproven that *might* occur between 0.0% and 0.0013% of the time really a problem that deserves Congressional attention?

Unfortunately, many in Congress and the media now think that submarine patents are a problem. Again, the notion is that unscrupulous inventors abuse large corporations by "hiding" their pending patents and causing them to be "delayed." Decades later, after what is patented is in common use, these patents "surface" and the inventors can legally extort millions in unearned royalties from their innocent corporate victims. The infamous Lemelson patent is used as an existence proof for this argument.

One of the undiscussed weak links in this argument is *how* and *why* the inventor could or would delay his patent. I don't know how or why. Once the inventor files, the timing of issue is under the control of the PTO. You file, and the PTO either grants or rejects. If they reject, the inventor is given a short time to respond or forever lose his right to patent that invention. Also, since the term of patents is now 20 years after *filing*, any and all delays in issuance come right out of the inventor's pocket.

The Details

Each of the bills introduced to implement the Lehman-Brown letters has been long and arcane, running to over a hundred pages. Each has had several in-

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carnations, some of which have been slipped into other legislation. If you really want to understand this, you should read HR 3460 in the 104th Congress, HR 400 and S.507 in the 105th Congress, and, the trickiest one of them all, HR 1907, now before this Congress. The text of each of these bills exists in several different forms, most of which can be found on Thomas (*http:// thomas.loc.gov/*). I will give references to the sections ("titles") in HR 1907.

The past legislation had some common key points, as does HR 1907. The first has always been a section on "PTO Modernization." Past versions have had it being "corporatized" and "separate."

What's so bad about that? Well, the catch is that some see this as an invitation to improper influence. Last year's bills legalized "gifts and donations" and removed the patent office (PTO) from the purview of the courts and Congress.

One of the bizarre results was a plan (still underway) to build a "patent palace," with a cost of two *billion* (that is not a misprint) dollars. That would make it by far the most expensive building ever built. That was deemed OK only if it was *not* the U.S. taxpayer that footed the bill. It was proposed that it be paid by fees assessed to the holders of patents and trademarks.

Work on the planned patent palace continues. That creates a major problem unless the PTO can be moved out from under the purview of a GSA audit before it is finished. HR 1907 is less blatant than its predecessors, but it accomplishes this removal by making the PTO Director a Presidential appointee, and making sure that *"only* the President" can remove the Director (the phrase "and only for cause" keeps popping in and out of the bill as well). It keeps the office under the Commerce Department, but removes it from the normal laws and audits that face government entities (Title VI).

In and of itself, some think Title VI will remove the PTO from the purview of the Congress and the courts. Once the Director is appointed he can do whatever he wants, and can change the rules in any way he wishes. In effect, Title VI makes the PTO Director a non-elected Technology Czar who is *only* accountable to the President. The other most troublesome proposed changes to patent law are "prior user rights" (now being called the first to invent defense), "18 month publication," and "improved examination procedures." These keep coming back.

Prior user rights allows prior commercial use as a defense against infringement. It is a compulsory license and will cause more litigation. It further shifts jobs and the balance of economic power from societies that innovate (our own), to those that manufacture (e.g., Japan, China). In HR 1907, these prior user rights are called "the first to invent defense," but it is the same thing (Title II).

In essence, prior user rights allows anyone to say, "Oh, we were using that before you got a patent. We didn't tell anyone. It was a trade secret. Too bad for you—you wasted your money and we can use it for free."

The 18-month pregrant publication of patent applications will prematurely and publicly disclose the intimate details of American inventions to competitors so they can begin production of the invention before its inventor has patent protection.

Remember that a unique characteristic of the U.S. patent system is *full* disclosure. In the past your secrets were safe. If you didn't get a patent, the PTO returned your information. If you did, well, then you had a patent to protect yourself. The 18-month rule changes that (Title IV).

One of the tricks in HR 1907 is to (possibly) not make 18-month disclosure apply if the inventor promises to never file a foreign patent. In any case, GAO reports the average significant patent, one with "parents," takes 47

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months to issue. It is not unusual for the key patents that start industries to take much longer.

A number of famous inventors published an open letter to President Clinton in the Washington *Post* noting that their key patents, from the MRI to kitty litter, took long periods to issue. That means that, in most cases, if you file a patent, the details of your invention will be published to the world—and to all your competitors—long before your patent ever issues.

Actually, under the proposed law, if your invention is significant I think your patent is unlikely to *ever* issue. The slam-dunk that closes off many inventors' chances is that the patent examination process itself turns into a gauntlet. In the past, getting a patent was a private matter. No longer.

"Improved examination procedures" or "third party rights" are a hunting license for giant multinationals and foreign cartels to bring their legal resources to bear against smaller firms and individual inventors, and a windfall for lawyers. The scope of examination proceedings of an issued patent is expanded. The third party challenger, who now has parallel rights with the inventor, is allowed (after reading his filing) to participate in the examination procedure (Title V).

The challenger may appeal the decision of the PTO, and may further appeal to the Federal Court if he does not like the decision of the PTO. More than one person can request a reexamination of a U.S. patent. A patent cannot be realistically enforced while a reexamination is in progress. Naturally, all this litigation must be funded by the inventor before he ever gets any revenue from his invention. Few can afford that.

There are other troubling things that have been in these bills, but removing the PTO from the U.S. body politic and the three points above have been omnipresent. To me, any one would suffice to quash any interest that I had in filing a patent or recommending that one of my clients do so. I just can't imagine anyone spending money on U.S. patents if all this passed into law.

Still, the specific details are complex, and will change as the new legislation comes into play and evolves. Lobbyists are skilled at deflecting criticism by saying, "Oh, that's been fixed."

Few have the time to actually read these bills, so I keep a status page (with links) posted at *http://www.trudelgroup.com/status.htm*. I frankly doubt that anyone understands the legislation fully, so the risk of unintended consequences is very high.

Better minds than mine, including a quorum of American's Nobel laureates, have warned of "lasting economic harm" and suggested that "extensive debate" is needed. Still, in an age where Washington lawyers can endlessly dispute the meaning of such simple words as "is" and "sex," the notion of watching Congress debate arcane patent law is somewhat mind-boggling. The last time our patent laws were changed (in only minor ways), it took two decades and a *Supreme Court ruling* to define the meaning of one word, "obviousness."

The problem of course, is that those pressing for these changes are effectively using patent law to change the Constitution (Article One, Section Eight) and to set economic policy.

So who is for this?

Since the consequences of the passage of these bills would seem to be harmful to innovation in the United States, one might assume that they would not have a broad base of support in Congress. One would be wrong. Most of the people in Washington, including about half of Congress, many of the trade organizations, and most of the lobbyists are actively promoting this legislation. Some of the groups you would think are the least likely to support it—e.g., the powerful American Electronics Association—are exactly the ones most for it. Why is this?

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First off, the most generous "donors" in Washington are foreign. These would benefit. In the long run, they would probably benefit more from stealing our PTO than from stealing our nuclear secrets.

Secondly, many large U.S. firms support the legislation. In folklore, all the deals with the devil are the same: The victim is promised short-term gratification in exchange for eternal damnation. Just so, most established companies are oligopolies or even monopolies. From cars to aircraft to software to telecom, most industries are dominated by between one and six firms. Many but not all of these established firms see new technology as more likely to pose a threat than to offer an opportunity.

Therefore, the chance to see what's coming before any patents are issued, and to use inventions free, has much appeal. (Frankly, I think this logic is badly flawed, but it exists nonetheless. Japan is hardly noted for its altruism in helping U.S. firms prosper.)

Thirdly, it is becoming traditional that in conflicts with Asian powers, we usually lose the first major battles before we even know there is a war on. Early in the patent wars we lost two key battles that may well cause us to lose the war. Clever lobbyists stuck 21 words into the voluminous, fast-tracked GATT treaty that "improved" our patent term from 17 years to 20 years. The trap was that it was 17 years after *issue* versus 20 years after *filing*. (One could write a book just about this trickery, which had not one, but four, levels of deception.) To cut to the chase, groups like the drug industry are now being held hostage. Their patents often take decades to issue, so a 20-year-from-filing term could put them out of business. They will agree to almost anything to get that fixed.

The second lost battle was when Congress suddenly and summarily closed its well-regarded Office of Technology Assessment on September 29, 1995. The office was nonpartisan and had been perceived as doing an excellent job for 23 years. But one day, *poof*, it was gone. The explanation given at the time was "cost savings."

Sure, that could be just a coincidence. Still, Congress now lacks an objective source of competent technology advice. Why pay for technology advice, when you can get it "free" from lobbyists who may even give you donations along with their counsel?

I could go on, but you get the idea. Impressive resources with deep pockets are promoting this legislation. By comparison, the opposition is ragtag and underfunded, ranging from universities, to Nobel laureates, to small inventors, and the venerable little old ladies of the DAR.

The news media are nonparticipants, as the issues are complex. With the possible exception of the "submarine patent" sound bite, there is very little about this issue that interests the media. It lacks celebrity identification, skid marks, and bullet holes. What could be more boring to the public than a discussion of patent law? Next to watching paint dry, I can't think of much.

Prognosis

What happens next in Washington is anyone's guess, but it is certain that the legislation to change our patent system will keep coming back until it either passes or is defeated in the "extensive public debate" our Nobel laureates requested. There is just too much money at stake for it to go away. Lobbyists swarm around the issue like flies, and I'm told that we are the only major trading nation that has not outlawed foreign lobbying.

HR 1907 is now on the floor of Congress. At this writing, the fight is over whether or not we should "suspend the rules" to force a vote without any debate, or give it fast track status. It was passed unanimously by Congressman Howard Coble's (R-NC) Republican-dominated committee and is supported by the Clinton Administration.

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So, in the end, we get back to the beginning: it's about punctuated equilibrium. Our old Cold War era media have yet to adapt to the new era. They still report events. The patent wars represent a systemic change to infrastructure, not an event.

For most of human history, the greatest threats to mankind were events. As Lester Thurow at MIT has noted, that is no longer true. From ecology, to crime, to education, to economic policy, to trade, the greatest threats are now systemic trends, many of which are discontinuous or exponential in nature. Our book, in a sense, is one of a new genre about leadership and life in times of chaos and non-linearity.

Strange assortments of people have banded together to fight the patent wars. Senator Orrin Hatch (R-UT) and Bill Gates, normally poles apart, worked to pass S.507 and change our patent system. Those opposing it were even more diverse.

Virginia Postrel explains this in *The Future and Its Enemies*. She notes that a common ritual in American political life is the "liberal" versus "conservative" TV debate. When the topic is the future, this format breaks down completely.[10]

Ms. Postrel suggests new labels. Hers are "stasists" and "dynamists." The former is fearful of the growing rate of technological change and chaos. They think the only hope is government regulation and control. The dynamists embrace change and freedom. The Internet is their Nirvana. It's a rich land of opportunity, a new frontier that is free (so far) of regulators and tax collectors.

Though the gasoline of foreign lobbying feeds the flames of the patent wars, the stasist versus dynamist polarity gives them purpose and political energy. Even though the U.S. has been unexcelled at innovation, should we slow it down? If we do, what are the consequences?

Japan traditionally supports its large *keiretsu* firms, while the United States has been a bastion of freedom and innovation. I expect we'll decide the fate of our patent system in the present Congress. I hope we base our decision on an open, informed debate, as the stakes are very high. Still, as Peggy Noonan noted in a recent *Wall Street Journal* column, today's politicians, "... use words not to reveal but to obscure, not to clarify but to confuse. They would mislead their way to power." That does not bode well.[11] ■

[*Author's note:* On August 4, 1999, HR 1907 passed the House with minor amendments. The tactics used to pass this bill were possibly unprecedented in the annals of Congress. The bill was passed under "suspension of the rules," a procedure that bars debate and allows only a verbal yes or no vote.

Suspension of the rules is a procedure is normally used *only* for the most noncontroversial of legislation—things like repairs to structures or the naming of bridges. One member of Congress, Kaptur of Ohio, insisted that she get a copy of the bill to read before the vote. She got her 105 page copy by special courier after 8 PM on August third. Since the vote was at approximately 10 AM on the fourth, it is safe to assume that very few in Congress had even read the bill and that none had a chance to talk to their constituents. For legislation that impacts the Constitution to be treated so casually is astonishing.

Therefore, the Patent Wars now move into the Senate. I am informed that a rarely used procedure called "stop at the desk" will be used to speed this legislation through the Senate. Senator Hatch and Congressman Hyde, the chairs of the respective Senate and House judiciary committees, have reportedly agreed to allow this. Under "stop at the bench" there are no committee hearings. Instead the bill in question is moved directly onto the Senate floor for vote.]

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John D. Trudel is CEO of The Trudel Group (TTG), a high technology management consulting firm that he established in 1988. He is a management consultant, author, and keynote speaker. He writes a popular column, "Trudel to Form" for Electronic Design *magazine. His most recent book,* Engines of Prosperity, *was excerpted by* IEEE Spectrum *in May 1999. John can be found at* www.trudelgroup.com.

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[1] Gerardo Ungson and John D. Trudel, *Engines of Prosperity: New Templates for the Information Age*, Imperial Press, 1998.

[2] Gerardo Ungson and John D. Trudel, *op cit.*

[3] In fact, in a highly acclaimed book, *The Knowledge Creating Company*, New York, Oxford University Press, 1995, authors Ikujiro Nonaka and Hirotaka Takeuchi argue that creating knowledge will become the key to sustaining a competitive advantage in the future. Another provocative book on this subject of knowledge creation is Taichi Sakaiya, *The Knowledge Value Revolution*, Tokyo, Kodansha International, 1991.

[4] Fumio Kodama, *Emerging Patterns of Innovation*, Harvard Business School Press, 1995.

[5] Donald M. Spero, "Patent Protection or Piracy – A CEO views Japan," *Harvard Business Review* reprint # 90511.

[6] Kodama's 1991 book, *Analyzing High Technologies: The Techno-Paradigm Shift*, won the highest awards in Japan. The book is not generally available in the West. His later work, *op cit.*, is recommended.

[7] So stated by Representative Pat Schroeder on the floor of Congress. Ms. Schroeder was at the time a proponent of HR 3460, the bill to change our patent system in the 1995-6 Congress.

[8] John D. Trudel, "The Great Patent Sellout," *Upside*, November 1995.

[9] See the links on my web page. *www.trudelgroup.com.*

[10] Virginia Postrel, *The Future and Its Enemies*, The Free Press, 1998.

[11] Peggy Noonan, "The Mad Boomer," *Wall Street Journal*

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Pauline Ashwell

TIME OUT OF JOINT

There's one sure way to provide the authenticity collectors say they want. . . .

Illustration by Broeck Steadman

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"I've been accused of robbing tombs, more than once," said my friend the Time Traveller, "and of handling forgeries, fakes and stolen goods, but this is the first time I've actually been called a thief."

In this century, the Time Traveller is an antiques dealer, specializing in objects from the Classical Period, between two to three thousand years ago. This trade has given rise to more types of profitable dishonesty than most, so that a reputation for probity is one of a dealer's most important assets. The other, of course, is his expertise. In a just world the Time Traveller's reputation would be spotless on both counts. His goods are always exactly as he describes them to be; he does not make even honest mistakes, because he buys directly from the artists or craftsmen who made them.

Unfortunately, he can hardly tell his customers that. When they disagree with his attribution of an object he can only defend it as an opinion, not a known fact. This can get very irritating, especially when dealing with the more opinionated type of collector. I often get to hear about it, because the Time Traveller drops in fairly regularly to let off steam. He always apologizes afterwards for imposing on my patience; but as a rule I enjoy it. This time, however, I was a good deal shocked.

I said, "Was the man mad?"

"Not only sane," said the Time Traveller ruefully, "but also perfectly sober, and one of my best customers, or he used to be—the Curator of the Sulven Collection. You may have heard of it."

I certainly had. It had been put together by an American billionaire who had erected a sumptuous building to house it, and then died.

"It was in the papers a few months ago," I said. "The heirs had been allowed to get out of paying inheritance tax on the collection provided they allowed reasonable public access to it, and the public—well, the part of it with an interest in Classical artifacts—complained about not being allowed in. Did part of it get stolen? But why on earth should they blame *you?*"

The Time Traveller poured himself another whisky—he brings a bottle whenever he visits me—and gave a deep sigh.

"You've probably read that a lot of stuff goes missing from museums, often without being noticed—the big ones have all sorts of things tucked away in storerooms and never seen except when some scholar puts in a special request."

"Well, yes," I said, "but I hadn't thought that the Sulven Collection was like that."

"It isn't. Old man Sulven only bought things that he had room to display. One of them was a certain vase; Athenian red-figure; there are dozens in the British Museum. The scenes painted on them are among the most importance sources of information about classical Greece."

"All the books on Greek history use them as illustrations," I said.

"Right. Well, I commissioned that vase from an Athenian potter living in Italy—the South was colonized from Greece in a big way—and had it painted with scenes from a performance of *The Frogs*. Sulven rather took to Aristophanes—said the plays were like a comic strip crossed with political cartoons—so I thought the vase would appeal to him. It did. That was about three years before he died.

"One of the men who'd been kicking up a fuss about being excluded from the collection was a student called Robinson who was writing a thesis on the Greek theatre. What he chiefly wanted was to study that vase. For some reason Greek artists don't seem to have liked the theatre as a subject. There are very few depictions of stage productions, and most of them come from Southern Italy, not mainland Greece.

"It was old man Sulven's heirs who wanted to keep the collection private, not the curator; he was only too pleased to have someone to talk to. Robinson

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mentioned that seeing there were so few pictures of *any* Greek play he wished the painter had chosen another one, because there was a vase painted with *The Frogs* in one of the Italian museums already. Then the curator ushered him into the room where the vase was kept and left him in front of its case.

"Ten minutes later Robinson shot out and asked at the top of his voice whether he knew that he was harboring stolen property; because the vase was the very one he'd studied in Italy three years before."

"Three years is quite a long time," I said.

"He'd photographed the vase from every angle and had copies in his briefcase. The curator went through them three times, standing in front of the vase, and ended up convinced that they were the same—I know what you're going to say," he added as I opened my mouth. "The painter could have painted another one exactly the same. Apart from the fact that the vase-painters never precisely repeated a design, he was not particularly pleased with that one. And anyway the vase had been slightly damaged while it was aging—a chunk of stone fell out of the cave's ceiling onto the crate and made a crack in the base. I'd had it repaired, of course, but it was still visible; and Robinson's photographs showed exactly the same repair."

I understood the reference to aging. If the Time Traveller sold his wares directly from the maker, modern tests would show that they were only a few years old. They are stored in an underground cavern somewhere in the Pliocene to rack up the appropriate number of centuries, so that tests for thermoluminescence and cosmic ray tracks give the right answer.

What I could not understand was how thus mixup could have occurred.

"The curator rang up the museum, of course," my friend continued gloomily, "and asked if one of his staff could visit and be shown the vase with the painting of *The Frogs*. After the usual runaround he was connected to the chief administrator, who said he knew the vase in question—someone had asked for it three years ago and there had been quite a fuss before they found out where it had been stowed. Nobody could say just where it was now; he rather thought it was on loan to an exhibition somewhere, but all the museum's records were in the process of being transferred to a computer and there was no way of finding out where anything was until that was complete."

"And I suppose he couldn't say when they obtained it, or how?" I said.

"*He* couldn't, but Robinson had a photocopy of the index card. The vase had been in the museum nearly ten years, having been purchased from a man named Massimo Colladi, for about half its market value. There were some codes which indicated that the museum had never dealt with the man before, and they'd checked that the vase was not on any list of stolen antiques."

It was all totally incomprehensible, except—

"This man Massimo," I exclaimed, "can he be from Elsewhere too?"

"Must be, I suppose," said the Time Traveller gloomily. "Nobody outside could have pulled it off. But *why?*"

The organization to which my friend belongs is based in another Universe—the pocket, not the alternative variety—which they refer to as Elsewhere. It was created at some time in the far future and peopled from many different periods on Earth.

Since even half the market value of the vase was probably a small fortune, *why* may seem to be obvious. The people of Elsewhere need money to purchase various items which it would be too difficult or too time-consuming to make for themselves: hence my friend's trading, and an assortment of other money-making activities. But within

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Elsewhere all needs are provided for centrally. Personal gain is not to the point.

I said, "What are you doing to do?"

"Go to Elsewhere, I suppose, and try to sort it out." He got to his feet with a faint groan, thanked me for my patience, and withdrew.

It was past my usual bedtime, but I remained sitting on the sofa for some minutes, wondering whether everybody in Elsewhere was really as indifferent to money as my friend seemed to believe. But having stolen the vase, why sell it ten years *earlier?* It might be sensible to carry it back six months, so as to sell it before it was missed, but ten years was overdoing it.

Presently I noticed that the room had grown cold. I got up and started for the kitchen, to make a hot drink to take up to bed.

As I reached for the handle the door flew open and I found myself face to face with the Time Traveller again.

Nowadays when he calls on me, the Time Traveller comes to the front door and rings the bell. I mentioned once or twice that the spectacle of a friend with his back apparently embedded, however briefly, in the plaster of the wall, was one I found disagreeable, and eventually it sank in. However, he finds it convenient to leave by way of a "Gate" in a corner of the hallway; which is why I do not escort him out. Seeing him, I thought that for some reason he had not yet left.

He said, "I found out what went wrong!"

"What, in ten minutes?" I exclaimed. Then I saw that he was wearing a different suit and had at least two days' stubble on his chin.

For a moment he looked thoroughly bewildered. Then he blinked.

"Oh, damn. I forgot to change settings on the Gate. You've had enough of me already, and you want to go to bed—"

"No, I don't," I said. "I shan't be able to sleep until I've heard about it. Come and sit down."

When he was back in his chair, with a glass of whisky in hand, he didn't seem to know how to begin. His lips parted several times, but nothing emerged. Finally he sighed and leaned back.

"Massimo Colladi was his real name," he said. "That's how I found him, in the end. What delayed me was that he won't be recruited for another month."

My own lips parted. Probably I gaped. The Time Traveller gave a weary nod.

"It threw me, too, and I've been living along two timelines for more than fifty years. But I've always tried to keep things synchronized—if I spend a year on Earth my next visit to Elsewhere will be a year later than the last, unless there's some reason to do otherwise. And I try to keep my visits to this century consecutive, though as you know I haven't always managed it."

The first time I noticed him he was in the British Museum twice, having made an appointment with one of the keepers and then, four years afterwards on his personal timeline, set up a meeting with another official half an hour later on the same day.

"I'd have thought everybody in Elsewhere would try to keep the times from getting out of joint," I said.

"They do. But recruits are slotted into any Orientation Class with a suitable vacancy. Recruits from similar place-times are never put together. The groups are made as varied as possible—race, religion, national and temporal affiliation, historical experience; the lot. The idea is to jar them loose from their birth-time as soon as possible."

"That sounds a bit . . ." I hesitated, wanting something stronger than "unkind" but not going so far as "brutal."

"They've all been pretty well cut off from their roots before they were recruited. Kids with a close family life or strong ties with their own society are left alone. The Recruiters look for those who for one reason or another are un-

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settled, unhappy, badly placed to make full use of their abilities. Cutting loose completely comes as a wrench, of course, however wretched they were, but they're picked for guts and adaptability as well as the rest. Most of them settle down fast.

"When Massimo Colladi got recruited he was not just wretched; he was angry. . . . He was a bright kid, born of bright parents—scientists, with wide interests and friends all over the social scale. They were killed by a drunken driver when he was thirteen and his father's brother took him in. He was not much like the father; a fairly typical suburban business man with a son about the same age as Massimo, but not nearly so intelligent—Massimo was two years ahead of him at school, which made for awkwardness. They all did their best to get along, but the feeling on both sides was one of tolerance rather than affection. The Recruiter for that place-time was interested from the start, but we don't take recruits younger than eighteen unless their situation is actually dangerous.

"The family was descended from Italian immigrants and there was a long-standing arrangement that Massimo's cousin should visit his relations in the Old Country when he was sixteen. His parents made a big thing of treating the two boys alike, so Massimo went too.

"The relatives were comfortably off; but like all families they had a black sheep, or at least dark gray. He was a dealer—in everything he could get hold of, including the occasional antique. There had been no plans for the boys to meet him, but he waylaid them one day, told them he was their cousin Ferdie, and took them to his house for lunch. He mentioned he'd lived there all his life and inherited it from his parents. That may not sound relevant, but it is.

"A more immediately significant contact was one of the older cousins who had reacted to his comfortable upbringing by becoming a priest, working by choice in a poverty-stricken area, and trying to do something about the problems there. He and Massimo took to one another, and towards the end of the visit the boy went to stay with him in his parish, much against the advice of the rest of the family.

"It was the first time he'd ever come up against real economic misery, and it hit him hard. When he got home he started paying attention to conditions there and was horrified to find that for some people they were much the same. His uncle and aunt took the line that they paid taxes for Welfare and gave money to charities and that was contribution enough.

"Massimo didn't agree. He'd inherited his parents' insurance and he wanted to hand over half of it to his priestly cousin. His uncle was trustee and tried to laugh him out of it. There was a row, which some of the neighbors heard; and shortly afterwards Massimo was approached by a group calling themselves Social Readjustment—"

I was not at all bored, but it was a long way past my bedtime. A yawn built up in my throat. I managed to keep my mouth shut, but the Time Traveller saw me swallow it.

"Briefly," he said, "Social Readjustment were the sort of group that starts out to improve the lot of their fellow men, without either the authority or the resources to do anything effective. If they don't simply fold, they often end by trying to take out their frustrations on some aspect of what that they see as the opposition. . . .

"I'm not sure why they fixed on the Sulven collection, but it was in the newspapers at the time, it involved wealthy people who had hung on to that part of their wealth by making promises that they refused to keep. Anyway the leading clique decided to adjust society by blowing up the building.

"Massimo Colladi was already fairly disillusioned and that finished the process. He called them a bunch of lu-

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natics, walked out, and sent an anonymous warning to the Sulven people. They said afterwards that they consider it a hoax.

"A week later there was an explosion in the pottery section of the Sulven building. Two bodies were found in the debris. They were identified and four of their associates were arrested. Massimo hadn't named them in his message; but shortly afterwards he had a narrow escape from being run down by a car, the windows of his uncle's house were broken, the garden was sprayed with plant-killing chemicals, and his uncle and aunt got threatening messages, accusing them of harboring a traitor. They sent for the police, who already knew Massimo had been involved with Social Readjustment—he hadn't kept it secret. His uncle and aunt were furious with him for bringing a bunch of urban terrorists down on them and might have thrown him out, but the police wanted him within reach. The recruiter decided it was time to approach.

"Massimo went through Orientation like a breeze and seemed to settle down almost at once. He worked in various sections and did well in all of them. He was popular and seemed thoroughly content. But at the back of his mind—he told me this himself, after I'd tracked him down—was the recollection that he'd intended to do something for underprivileged people and had totally failed. He had promised to send money to his cousin the priest, but he hadn't even managed that. It rankled.

"His own money was out of his reach—probably at some point his relatives had him presumed dead. But he had an idea for getting hold of some more. When the Sulven building was blown up most of the pottery was blown almost to dust; not much could be identified. He decided to remove as much of it as he could before the explosion took effect."

I must have made a noise, because the Time Traveller looked up and nodded. "Yes," he said. "That was how the Frog vase came to be in two places at once.... It took Massimo several years to work out how he could get hold of it. Access to Gates connecting to place-times in human history is restricted to people whose work requires it. His did not. However, there is one other group involved with the Gates: the technicians who keep them in working order. They don't have the kind of keys that we use, but they have instruments that do the same job. Massimo cultivated friendships with some of them—he's a genuinely friendly chap with a great deal of charm—told the most susceptible a sob story about reclaiming some family treasure for its rightful owners, and got them to rig a Gate to coordinates he supplied.

"Even so, his raid did not go exactly to plan. He got through into a storeroom in the Sulven building, opened the nearest door and immediately set off an alarm. He heard running feet—very possibly belonging to Social Readjustment—and shut the door in a hurry. There was a crate in the storeroom plastered with FRAGILE labels, so he grabbed it and shot back through the Gate. When he opened it he found a Greek vase inside."

The Time Traveller paused for a sip of whisky, and sighed.

"You know, he must have planned something like this even when he was first recruited—at any rate he took his passport with him, and all the Italian money he had left—cashed his remaining travellers' cheques for lire as well. Otherwise he could hardly have worked the Italian side of the scheme.... The next set of coordinates landed him just outside Ferdie's house around dawn, ten years or so before his first visit, with the crated vase in his arms. He also had his passport, with the date of his birth changed appropriately; and introduced himself as a relative from America, needing help with a deal.

"Ferdie knew just which museum to

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go to. He took twenty-five percent of the proceeds and they only got half the true market value, but it was enough for Massimo's scheme. While in Italy before—that is, ten years later—he'd noticed that a certain software company was in the headlines because the value of its shares had doubled more or less overnight. It had been expanding steadily for more than a decade, but its latest product was having a spectacular success. Massimo bought as many shares as he could and left them with an attorney whom his relatives swore by, instructing him to keep them until a specified date, then sell them and set up a charitable trust under the priest cousin's control.

"The lawyer protested—for one thing the cousin was only twenty and hadn't shown any particular interest in charitable work—but it was part of his religion to follow clients' instructions exactly, even if he thought they were mad, and in the end he agreed.

"Massimo handed over his remaining lire to Ferdie—he had no intention of using them again—and returned through his Gate. It was set to deliver him back to Elsewhere two minutes after his departure, however long he remained on Earth, so he hadn't been missed. His one miscalculation was to have left Rome at night after a busy day, and returned to Elsewhere first thing in the morning. He described graphically how exhausted he felt at the end of that day."

"Serves him right," I said.

"Perhaps," said the Time Traveller thoughtfully, "but I seem to have forgiven him. He could hardly have foreseen the trouble he was going to cause."

"He's still done horrible damage to your reputation."

"Oh, that will right itself in time. The Italian Museum will get its computer working eventually and find out what it has done with the Frog vase. The one from the Sulven Collection is no longer available for comparison. No photograph of it was ever published and those in the collection's records were destroyed in the explosion. I shall see to it that Robinson and the Sulven people are duly notified and everybody will conclude that one of the vases must have been a copy of the other, after all."

"Truth takes a long time to catch up with lies," I said. "Or even mistakes."

"I know," said the Time Traveller. He finished his whisky and put down the glass. "Maybe it's time I retired."

About half of our conversations end like that. Maybe one day he will really mean it; but not, I think, for a while yet. ■

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Mike Resnick

WHY MARTIANS ARE ATTRACTED TO BIG-BREASTED WOMEN

A Serious Essay

H. Rider Haggard knew. He tried to warn us.

So did Edmund Hamilton and Henry Kuttner and Jack Williamson.

You think not?

Then try this on for size: "Her hair was golden and flowing, her cheeks prominent, her eyes a brilliant blue, her firm alabaster breasts high and proud."

That was Kuttner. And now here's Kuttner as Lewis Padgett, one of his many pseudonyms: "Her firm alabaster bosom quivered in fright."

Knowing what we know about them now, it's hard to see how a Martian could resist. (And not a lot of them did. Resist, I mean.)

Then there was the old Lensman himself, E. E. "Doc" Smith. He wasn't much for describing his women once he got beyond their hair color and weaponry, but he managed this one: "She placed her hand to her full, ripe alabaster breasts."

You know how many copies of that wound up on the Red Planet? (Just in case you ever wondered why the pulps that carried Doc's old stories are so rare and so expensive, now you've got your answer.)

Take a look at the magazines back when Ed Hamilton and Jack Williamson were destroying and saving the galaxy every other week. Be honest now: did you ever see a description of ivory skin, or golden skin, or supple Nubian skin?

Come on, admit it. You never did. Not even once.

Because they were in on it, and they were trying to let *us* in on it too. That's why it was never gold or red or brown, but always alabaster.

(Edgar Rice Burroughs never caught on. That's why *his* Martian women are all red or green.)

Anyway, after awhile a few science fiction writers went off to Hollywood: Bob Bloch, Ray Bradbury, Richard Matheson, even Ted Sturgeon for awhile. And they must have passed the word. That's why neither Audrey nor Katherine Hepburn were ever cast in a science fiction film. It wouldn't have been *realistic*. The Martians would have known in a New York minute.

I don't know when it started. It had to be after Einstein came up with his theory in 1905, we know that much. They listened in on our radio transmissions, but they couldn't distinguish the subtleties of accent and pronunciation.

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They messed around with "new clear physics" for years before they decided there was nothing clear about it at all. Part of the problem was a lack of fission. (Reason it out, and remember their weakness: you can't go fishin' when all the canals have dried up.)

So they created a whole new science, and began building a powerful war machine. They didn't have any plutonium, and there wasn't even any wood or coal to burn, but faced with the necessity of finding a new energy source, they made an amazing breakthrough. To this day our scientists don't know how they managed it, or what the governing principle is, but they were soon able to power a spaceship capable of delivering a major bomb to any of Earth's cities by releasing the energy within just three pounds of—you guessed it—alabaster.

All the governments of Earth (and this was long before there was a United Nations, or even its earlier incarnation, the League of Nations; in fact, those concepts probably came from this unified action) agreed to clamp a cone of silence on all this, fearing a worldwide panic if news of a potential alien invasion got out.

And there might well have been a successful invasion if it hadn't been for the science fiction writers. That mentally, morally and emotionally superior group of humans had no trouble extrapolating the existence of the Martians, and they soon realized that while the Martians were centuries away from unlocking the secrets of the atom, they had already unlocked the secret of alabaster.

A few of the early ones tried to publish essays or make speeches, warning of the danger. They were never seen or heard from again. (Just in case you ever wondered what happened to Sybly White and Keith Winton, who vanished from the pages of the magazines shortly after their much-heralded debuts.)

The remaining science fiction writers were more careful not to alert the government or the Martians. They didn't address the issue directly. They made no speeches. They wrote no essays. They caused no panics.

Instead, they started putting these subtle hints into their stories, convinced that the readers of science fiction—the second most superior minds on the planet, after only the writers themselves—would quickly catch on to what they were doing.

In the early years, every single one of those alabaster-breasted women was a Martian. Never an Arcturian or a Neptunian. Check it out; you'll see how clever they were.

There was only one problem: Martians are tremendously self-centered and egomaniacal. When they weren't working with their dwindling supply of alabaster or making little Martians, they spent all their time looking at themselves in mirrors and reading about themselves in science fiction stories that turncoat humans smuggled out to them.

Once the writers realized that the Martians had access to their stories, they split into two camps. Isaac Asimov and his followers believed in the ultimate goodness and rationality of all beings, and felt that the Martians did not pose a serious threat. (And you'll notice that, in all his fiction, he never once used the word "alabaster".) But Robert A. Heinlein convinced *his* followers that it was foolish to trust a race that was already constructing interplanetary alabaster-powered dreadnoughts. He felt it was essential to keep preparing the readers without warning the Martians, so in September of 1948 he issued an edict that every science fiction writer from that day until the present has honored: we would continue to prepare our readers, but we would mislead the enemy by never again allowing the words "alabaster" and "Martian" to appear in the same story.

(John Campbell never believed in the Martians, let alone the Martian threat. As a result, he rejected any story containing the code words. That was when Hein-

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lein left him for other markets. And, in fact, the Martians themselves stopped reading *Astounding* long before it changed its name to *Analog*, doubtless one of the reasons that it had to raise its cover price so often during the following decade.)

But it was too late. Mars was running short of alabaster to fire the engines of war (and of peace, for that matter; Martian winters can get pretty cold), and suddenly twenty million Martians were absolutely convinced that all human women had enormous reserves of alabaster built into their chests.

(That's when they began collecting copies of *Playboy* and *Rogue* and *Nugget* and all the other girlie magazines. Since they had a limited amount of space in their ships, they began creating a database of the women with the biggest breasts, so that when they finally invaded us and kidnapped our females they would abduct only the most energy-efficient ones.)

Then came the Tragedy of 1966. Some science fiction writer—I won't honor him by repeating his name—sold the secret to Hollywood, and shortly thereafter the theaters of America were flooded with prints of *Mars Wants Women*. (No, I'm not kidding. Check your Maltin or Ebert Movie Guides. 1966. *Mars Wants Women*.)

To this day I don't know whose side he was on. Was he trying to warn us, or was he trying to show the Martians how easy it is to kidnap Earth women with alabaster breasts?

It was when *Variety* announced that a sequel was in the works that the science fiction community realized it had no choice. Using the cover of the recently formed Science Fiction Writers of America, we worked silently but quickly, and by the end of 1966 not a single person associated with the film was left alive. (Don't scoff. You haven't seen any of them on screen since then, have you?)

Fortunately, the film was such a bomb that no Martian ever saw it. That gave us time to keep spreading the word before the eventual invasion. (And we needed the time, because the Science Fiction Writers of America were so busy hosting drunken revelries to hide our true purpose that we hardly ever got around to the real business of devising new means of disseminating the information.)

Because we knew the Martians were avidly reading the magazines, and later the books, we became more subtle than ever. When Robert Silverberg described a woman with "pendulous alabaster globes," he was forcing the Martians to consider whether they wanted women with pendulous breasts, or the old ripe pouting ones of the Kuttner era. It is estimated that the ensuing debate among the Martian scientists delayed the invasion by at least two decades.

Then Barry Malzberg applied his devilish genius to the problem, and in a single story described "alabaster breasts," "alabaster boobs," and "alabaster tits." Now the Martians were thoroughly confused, and it would take them additional years to determine whether or not there was a meaningful difference in the terms.

Maybe the most bizarre description of all was by Judith Tarr, in a story I commissioned for an anthology I was editing. In describing a room, she mentioned that it was illuminated by alabaster globes. (I am told on excellent authority that fifty-seven Martian scientists committed suicide upon reading this totally contradictory use of the term. The Martians have many good qualities, but adjusting to new concepts isn't one of them.)

So that's where things stand. Each new generation of writers finds new ways to alert humans and simultaneously thwart the Martians.

Now if we can just keep the Dolly Parton videos out of their hands . . . ■

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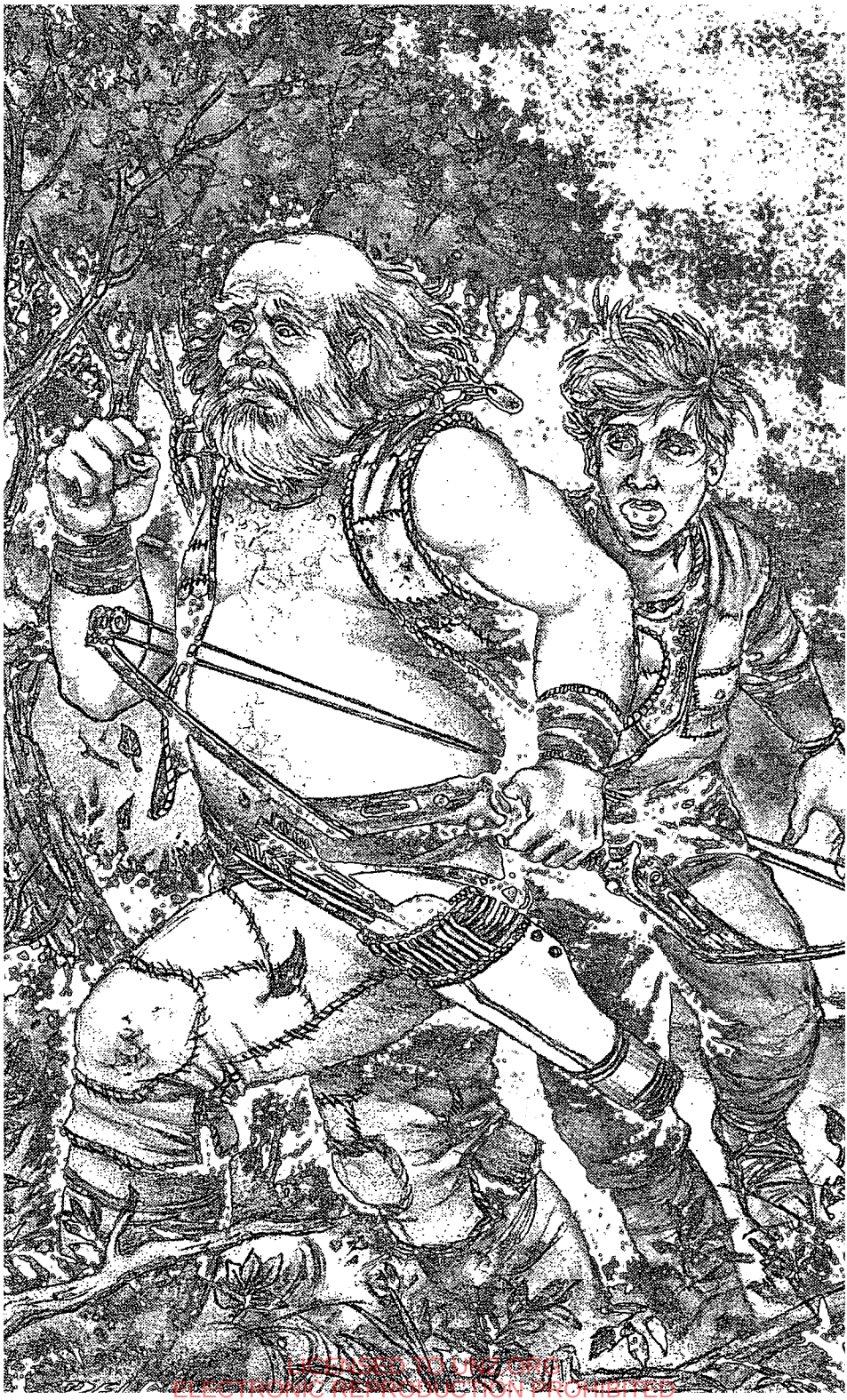

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GREENHOUSE CHILL

One of our biggest problems is that things look so constant on a human time scale that it's hard to grasp the truth. . . .

Illustration by Dell Harris

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"You're lost, maybe. I know right where I am."

Squinting in the bright sunshine, Tim turned his head this way and that, searching the horizon. Nothing. Not another sail, not another boat anywhere in sight. Not even a bird. The only sounds he could hear were the soft gusting of the hot breeze and the splash of the gentle waves lapping against their stolen sailboat. The brilliant sky was cloudless, the sea stretched out all around them, and they were alone. Two teenaged runaways out in the middle of the empty sea.

"Yeah?" Tim challenged. "Then where are we?"

"Comin' up to the Ozarks, just about," said Hawk.

"How d'you know that?"

Hawk's frown evolved into a serious, superior, *knowing* expression. He was almost a year older than Tim, lean and hard-muscled from backbreaking farm labor. But his round face was animated, with sparkling blue eyes that could convince his younger friend to join him on this wild adventure to escape from their parents, their village, their lives of endless drudgery.

Tim was almost as tall as Hawk, but pudgier, softer. His father was the village rememberer, and Tim was being groomed to take his place in the due course of time. The work he did was mostly mental instead of physical, but it was pure drudgery just the same, remembering all the family lines and the history of the village all the way back to the Flood.

"So," Tim repeated, "how d'you know where we are? I don't see any signposts stickin' up outta the water."

"How long we been out?" Hawk asked sternly.

With a glance at the dwindling supply of salt beef and apples in the crate by the mast, Tim replied, "This is the fifth mornin'."

"So the Sun's behind your left shoulder, same's it's been every mornin'. Wind's still comin' up from the south, hot and strong. We're near the Ozarks."

"I still don't see how you figure that."

"My dad and my uncle been fishin' in these waters all their lives," Hawk said, matter-of-factly. "I learned from them."

Tim thought that over for a moment, then asked, "So how long before we get to Colorado?"

"Oh, that's *weeks* away," Hawk answered.

"Weeks? We ain't got enough food for weeks!"

"I know that. We'll put in at the Ozark Islands and get us some more grub there."

"How?"

"Huntin'," said Hawk. "Or trappin'. Or stealin', if we hafta."

Tim's dark eyes lit up. The thought of becoming robbers excited him.

The long lazy day wore on. Tim listened to the creak of the ropes and the flap of the heavy gray sail as he lay back in the boat's prow. He dozed, and when he woke again the Sun had crawled halfway down toward the western edge of the sea. Off to the north, though, ominous clouds were building up, gray and threatening.

"Think it'll storm?" he asked Hawk.

"For sure," Hawk replied.

They had gone through a thunderstorm their first afternoon out. The booming thunder had scared Tim halfway out of his wits. That and the waves that rose up like mountains, making his stomach turn itself inside out as the boat tossed up and down and sideways and all. And the lightning! Tim had no desire to go through that again.

"Don't look so scared," Hawk said, with a tight smile on his face.

"I ain't scared!"

"Are too."

Tim admitted it with a nod. "Ain't you?"

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"Not any more."

"How come?"

Hawk pointed off to the left. Turning, Tim saw a smudge on the horizon, something low and dark, with more clouds over it. But these clouds were white and soft-looking.

"Island," Hawk said, pulling on the tiller and looping the rope around it to hold it in place. The boat swung around and the sail began flapping noisily.

Tim got up and helped Hawk swing the boom. The sail bellied out again, neat and taut. They skimmed toward the island while the storm clouds built up higher and darker every second, heading their way.

They won the race, barely, and pulled the boat up on a stony beach just as the first drops of rain began to spatter down on them, fat and heavy.

"Get the mast down, quick!" Hawk commanded. It was pouring rain by the time they got that done. Tim wanted to run for the shelter of the big trees, but Hawk said no, they'd use the boat's hull for protection.

"Trees attract lightnin', just like the mast would if we left it up," said Hawk.

Even on dry land the storm was scary. And the land didn't stay dry for long. Tim lay on the ground beneath the curve of the boat's hull as lightning sizzled all around them and the thunder blasted so loud it hurt his ears. Hawk sprawled beside Tim and both boys pressed themselves flat against the puddled stony ground.

The world seemed to explode into a white-hot flash and Tim heard a crunching, crashing sound. Peeping over Hawk's shoulder he saw one of the big trees slowly toppling over, split in half and smoking from a lightning bolt. For a moment he thought the tree would smash down on them, but it hit the ground a fair distance away with an enormous shattering smash.

At last the storm ended. The boys were soaking wet and Tim's legs felt too weak to hold him up, but he got to his feet anyway, trembling with cold and the memory of fear.

Slowly they explored the rocky, pebbly beach and poked in among the trees. Squirrels and birds chattered and scolded at them. Tim saw a snake, a beautiful blue racer, slither through the brush. Without a word between them, the boys went back to the boat. Hawk pulled his bow and a handful of arrows from the box where he had stored them while Tim collected a couple of pocketfuls of throwing stones.

By the time the Sun was setting they were roasting a rabbit over their campfire.

Burping contentedly, Hawk leaned back on one elbow as he wiped his greasy chin. "Now this is the way to live, ain't it?"

"You bet," Tim agreed. He had seen some blackberry bushes back among the trees and decided that in the morning he'd pick as many as he could carry before they started out again. No sense leaving them to the birds.

"Hello there!"

The deep voice froze both boys for an instant. Then Hawk dived for his bow while Tim scrambled to his feet.

"Don't be frightened," called the voice. It came from the shadowy bushes in among the trees, sounding ragged and scratchy, like it was going to cough any minute.

On one knee, Hawk fitted an arrow into his hunter's bow. Tim suddenly felt very exposed, standing there beside the fire, both hands empty.

Out of the shadows of the trees stepped a figure. A man. An old, shaggy, squat barrel of a man in a patchwork vest that hung open across his white-fuzzed chest and heavy belly, his head bare and balding but his brows and beard and what was left of his hair bushy and white. His arms were short, but thick with muscle. And he carried a strange-looking bow, black and powerful-looking, with all kinds of weird attachments on it.

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"No need for weapons," he said, in his gravelly voice.

"Yeah?" Hawk challenged, his voice shaking only a little. "Then what's that in your hand?"

"Oh, this?" The stranger bent down and laid his bow gently on the ground. "I've been carrying it around with me for so many years it's like an extension of my arm."

He straightened up slowly, Tim saw, as if the effort caused him pain. There was a big, thick-bladed knife tucked in his belt. His feet were shod in what looked like strips of leather.

"Who are you?" Hawk demanded, his bow still in his hands. "What do you want?"

The stranger smiled from inside his bushy white beard. "Since you've just arrived on my island, I think it's more proper for you to identify yourselves first."

Tim saw that Hawk was a little puzzled by that.

"Whaddaya mean, your island?" Hawk asked.

The old man spread his arms wide. "This is my island. I live here. I've lived here for damned near two hundred years."

"That's bull-dingy," Hawk snapped. Back home he never would have spoken so disrespectfully to an adult, but things were different out here.

The shaggy old man laughed. "Yes, I suppose it does sound fantastic. But it's true. I'm two hundred and fifty-six years old, assuming I've been keeping my calendar correctly."

"Who are you?" Hawk demanded. "Whatcha want?"

Placing a stubby-fingered hand on his chest, the man replied, "My name is Julius Schwarzkopf, once a professor of meteorology at the University of Washington, in St. Louis, Missouri, U. S. of A."

"I heard of St. Louie," Tim blurted.

"Fairy tales," Hawk snapped.

"No, it was real," said Professor Julius Schwarzkopf. "It was a fine city, back when I was a teacher."

Little by little, the white-bearded stranger eased their suspicions. He came up to the fire and sat down with them, leaving his bow where he'd laid it. He kept the knife in his belt, though. Tim sat a little bit aways from him, where there were plenty of fist-sized rocks within easy reach.

The Prof, as he insisted they call him, opened a little sack on his belt and offered the boys a taste of dried figs.

As the last embers of daylight faded and the stars began to come out, he suggested, "Why don't you come to my place for the night? It's better than sleeping out in the open."

Hawk didn't reply, thinking it over.

"There's wild boars in the woods, you know," said the Prof. "Mean beasts. And the cats hunt at night, too. Coyotes, of course. No wolves, though; for some reason they haven't made it to this island."

"Where's your cabin?" Hawk asked. "Who else lives there?"

"Ten minutes' walk," the Prof answered, pointing with an outstretched arm. "And I live alone. There's nobody but me on this island—except you, of course."

The old man led the way through the trees, guiding the boys with a small greenish lamp that he claimed was made from fireflies' innards. It was fully dark by the time they reached the Prof's cabin. To Tim, what little he could make out of it looked more like a bare little hump of dirt than a regular cabin.

The Prof stepped down into a sort of hollow and pushed open a creaking door. In the ghostly green light from his little lamp, the boys stepped inside. The door groaned and closed again.

And suddenly the room was brightly lit, so bright it made Tim squeeze his eyes shut for a moment. He heard Hawk gasp with surprise.

"Ah, I forgot," the Prof said. "You're not accustomed to electricity."

The place was a wonder. It was mostly underground, but there were lights that

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made everything like it was daytime. And there were lots of rooms; the place just seemed to go on and on.

"Nothing much else to do for the past two centuries," the Prof said. "Home improvement was always a hobby of mine, even back before the Flood."

"You remember before the Flood?" Tim asked, awed.

The Prof sank his chunky body onto a sagging, tatty sofa and gestured to chairs for the boys to sit on.

"I was going to be one of the Immortals," he said, his rasping voice somewhere between sad and sore. "Got my telomerase shots. I'd never age—so long as I took the booster shots every fifty years."

Tim glanced at Hawk, who looked just as puzzled as he himself felt.

"But then the Flood wiped all that out. I'm aging again . . . slowly, I grant you, but just take a look at me! Hardly immortal, right?"

Hawk pointed to the thickly stacked shelves lining the room's walls. "Are all those things books?"

The Prof nodded. "My other hobby was looting libraries—while they were still on dry land."

He babbled on about solar panels and superconducting batteries and refrigerators and all kinds of other weird stuff that started to make Tim's head spin. It was like the Prof was so glad to have somebody to talk to he didn't know when to stop.

Tim had always been taught to be respectful of his elders; sometimes the lessons had included a sound thrashing. But no matter how respectfully he tried to pay attention the Prof's rambling, barely understandable monologue, he kept drifting toward sleep. Back home everybody was abed shortly after nightfall, but now this Prof was yakking on and on. It must be pretty near midnight, Tim thought. He could hardly keep his eyes open. He nodded off, woke himself with a start, tried as hard as he could to stay awake.

"But look at me," the Prof said at last. "I'm keeping you two from a good night's sleep, talking away like this."

He led the boys to another room that had real beds in it. "Be careful how you get on them," he warned. "Nobody's slept in those antiques in fifty years or more, not since a family of pilgrims got blown off their course for New Nashville. Stayed for damned near a month. Ate me out of house and home, just about, but I was still sad to see them go. I . . ."

Hawk yawned noisily and the Prof's monologue petered out. "I'll see you in the morning. Have a good sleep."

Tim didn't care about the Prof's warning. He was so sleepy he threw himself on the bare mattress of the nearer bed. He raised a cloud of dust, but after one cough he fell sound asleep.

Because the Prof's home was mostly underground it stayed dark long after sunrise. Tim and Hawk slept longer than they ever had at home. Only the sound of the Prof knocking hard on their bedroom door woke them.

The boys washed and relieved themselves in a privy that was built right into the house, in a separate little room of its own, with running water at the turn of a handle.

"Gravity feed," the Prof told them over a hearty breakfast of eggs and ham and waffles and muffins and fruit preserves. "Got a cistern for rainwater up in the hills and pipes carry the water here. I boil all the drinking and cooking water, of course."

"Of course," Hawk mumbled, his mouth full of blueberry muffin.

"We've got to haul your boat farther up out of the water," the Prof said, "and tie it down good and tight. Big blow likely soon."

Tim glanced out the narrow slit of the kitchen's only window and saw that it was dull gray outside, cloudy.

Once they finished breakfast, the Prof took them to still another room. This one had desks and strange-looking boxes

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sitting on them, with windows in them.

The Prof slipped into a little chair that creaked under his weight and started pecking with his fingers on a board full of buttons. The window on the box atop the desk lit up and suddenly showed a picture.

Tim jerked back a step, surprised. Even Hawk looked wide-eyed, his mouth hanging open.

"Not many weather satellites still functioning," the Prof muttered, as much to himself as the boys. "Only the old military birds left; rugged little buggers. Hardened, you know. But even with solar power and gyro stabilization, after two hundred years they're crapping out, one by one."

"What is that?" Hawk asked, his voice strangely small and hollow. Tim knew what was going through his friend's mind: *This is witchcraft!*

The Prof launched into an explanation that meant practically nothing to the boys. Near as Tim could figure it, the old man was saying there was a machine hanging in the air like a circling hawk or buzzard, but miles and miles higher, so high they couldn't see it. And the machine had some sort of eyes on it and this box on the Prof's desk was showing what those eyes saw.

It didn't sound like witchcraft, the way the Prof explained it. He made it sound just as natural as chopping wood.

"That's the United States," the Prof said, tapping the glass that covered the picture. "Or what's left of it."

Tim saw mostly wide stretches of blue stuff that sort of looked like water, with plenty of smears of white and gray. Clouds?

"Florida's gone, of course," the Prof muttered. "Most of the midwest has been inundated. New England . . . Maryland and the whole Chesapeake region . . . all flooded."

His voice had gone low and soft, as if he was about to cry. Tim even thought he saw a tear glint in one of the old man's eyes, though it was hard to tell, under those shaggy white brows of his.

"Here's where we are," the Prof said, pointing to one of the gray smudges. "Can't see the island, of course; we're beneath the cloud cover."

Tim looked at Hawk, who shrugged. Couldn't figure out if the Prof was crazy or a witch or what.

The Prof tapped at the buttons on the oblong board in front of him and the picture on the box changed. Now it showed something that was mostly white. Lots of clouds, still, but they were almost all white and if that was supposed to be ground underneath them the ground was all white, too.

"Canada," said the Prof, grimly. "The icecap is advancing fast."

"What's that mean?" Hawk asked.

The Prof sucked in a big sigh and looked up at the boys. "It's going to get colder. A lot colder."

"Winter's comin' already?" Tim asked. It was still springtime, he knew. Summer was coming, not winter.

But the Prof answered, "A long winter, son. A winter that lasts thousands of years. An ice age."

Hawk asked, "What's an ice age?"

"It's what follows a greenhouse warming. This greenhouse was an anomaly, caused by anthropogenic factors. Now the cee-oh-two's being leached out of the atmosphere and the global climate will bounce back to a Pleistocene condition."

He might as well have been talking Cherokee or some other redskin language, Tim thought. Hawk looked just as baffled.

Seeing the confusion on the boys' faces, the Prof went to great pains to try to explain. Tim got the idea that he was saying the weather was going to turn colder, a lot colder, and stay that way for a *really* long time.

"Glaciers a mile thick!" the Prof said, nearly raving in his earnestness. "Minnesota, Michigan, the whole Great Lakes region was covered with ice a mile thick!"

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"It was?"

"When?"

Shaking his head impatiently, the Prof said, "It doesn't matter when. The important thing is that it's going to happen all over again!"

"Here?" Tim asked. "Where our folks live?"

"Yes!"

"How soon?" asked Hawk.

The Prof hesitated. He drummed his fingers on the desktop for a minute, looking lost in thought.

"By the time you're a grandfather," he said at last. "Maybe sooner, maybe later. But it's going to happen."

Hawk let a giggle out of him. "That's a long time from now."

"But you've got to get ready for it," the Prof said, frowning. "It will take a long time to prepare, to learn how to make warm clothing, to grow different crops or migrate south."

Hawk shook his head.

"You ought to at least warn your people, let them know it's going to happen," the Prof insisted.

"But we're headin' for Colorado," Tim confessed. "We're not goin' back home."

The Prof's bushy brows knit together. "This climate shift could be just as abrupt as the greenhouse cliff was. People who aren't prepared for it will die—starve to death or freeze."

"How do you know it's gonna happen like that?" Hawk demanded.

"You saw the satellite imagery of Canada, didn't you?"

"We saw some picture of something, I don't know what it really was," Hawk said. "How do you know what it is? How do you know it's gonna get so cold?"

The Prof thought a moment, then admitted, "I don't *know*. But all the evidence points that way. I'm sure of it, but I don't have conclusive proof."

"You don't really know," Hawk said.

For a long moment the old man glared at Hawk angrily. Then he took another deep breath and his anger seemed to fade away.

"Listen, son. Many years ago people like me tried to warn the rest of the world that the greenhouse warming was going to drastically change the global climate. All the available evidence pointed to it, but the evidence was not conclusive. We couldn't convince the political leaders of the world that they were facing a disaster."

"What happened?" Tim asked.

Spreading his arms out wide, the Prof shouted, "This happened! The world's breadbaskets flooded! Electrical power distribution systems totally wiped out. The global nets, the information and knowledge of centuries—all drowned. Food distribution gone. Cities abandoned. Billions died! Billions! Civilization sank back to subsistence agriculture."

Tim looked at Hawk and Hawk looked back at Tim. Maybe the old man isn't a witch, Tim thought. Maybe he's just crazy.

The Prof sighed. "It doesn't mean a thing to you, does it? You just don't have the understanding, the education or . . ."

Muttering to himself, the old man turned back to his magic box and pecked at the buttons again. The picture went back to the first one the boys had seen.

Abruptly the Prof jabbed a button and the picture winked off. Pushing himself up from his chair, he said, "Come on, we've got to get your boat farther up out of the water and tied down good and strong."

"What for?" Hawk demanded, suddenly suspicious.

With a frown, the Prof said, "This area used to be called Tornado Alley. Just because it's covered by water doesn't change that. In fact, it makes the twisters even worse—bigger, slower. They just crawl along and pound away at you for hours, seems like."

The boys had heard of twisters. One had levelled a village not more than a day's travel from their own, only a couple of springtimes ago.

When it came, the twister was a monster.

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The boys spent most of the day hauling their boat up close to the trees and then tying it down as firmly as they could. The Prof provided ropes and plenty of advice and even some muscle power. All the time they worked the clouds got thicker and darker and lower. Tim expected a thunderstorm any minute as they headed back for the Prof's house, bone tired.

They were halfway back when the trees began tossing back and forth and rain started spattering down. Leaves went flying through the air, torn off the trees. A whole bough whipped by, nearly smacking Hawk on the head. Tim heard a weird sound, a low dull roaring, like the distant howl of some giant beast.

"Run!" the Prof shouted over the howling wind. "You don't want to get caught here amidst the trees!"

Despite their aching muscles they ran. Tim glanced over his shoulder and through the bending, swaying trees he saw a mammoth pillar of pure terror marching slowly across the open water, heading right for him, sucking up water and twigs and anything in its path, weaving sluggishly back and forth, high as the sky, bearing down on them, coming to get him.

It roared and shouted and moved up onto the land. Whole trees were ripped up by their roots. Tim tripped and sprawled face-first into the dirt. Somebody grabbed him by the scruff of his neck and yanked him to his feet. The rain was so thick and hard he couldn't see an arm's length in front of him but suddenly the low earthen hump of the Prof's house was in sight and the old man, despite his years, was half a dozen strides ahead of them, already fumbling with the front door.

They staggered inside, the wind-driven rain pouring in with them. It took all three of them to get the door closed again and firmly latched. The Prof pushed a heavy cabinet against the door, then slumped to the floor, soaking wet, chest heaving.

"Check . . . the windows," he gasped. "Shutters . . ."

Hawk nodded and scrambled to his feet. Tim hesitated only a moment, then did the same. He saw there were thick wooden shutters folded back along the edges of each window. He pulled them across the glass and locked them tight.

The twister roared and raged outside but the Prof's house, largely underground, held firm. Tim's ears popped and he thought the ground was shaking, but maybe it was just him shaking, he was so scared. The storm yowled and battered at the house. Things pounded on the roof. The rain drummed so hard it sounded like all the redskins in the world doing a war dance.

The Prof lay sprawled in the puddle by the door until Hawk gestured for Tim to help him get the old man to his feet.

"Bedroom . . ." the Prof said. "Let me . . . lay down . . . for a while." His chest was heaving, his face looked gray.

They put him down gently on his bed. His wet clothes made a squishy sound on the covers. He closed his eyes and seemed to go to sleep. Tim stared at the old man's bare, white-fuzzed chest. It was pumping up and down, fast.

Something crashed against the roof so hard that books tumbled out of their shelves and dust sifted down from the ceiling. The lights blinked, then went out altogether. A dim lamp came on and cast scary shadows on the wall.

Tim and Hawk sat on the floor, next to each other, knees drawn up tight. Every muscle in Tim's body ached, every nerve was pulled tight as a bowstring. And the twister kept howling outside, as if demanding to be allowed in.

At last the roaring diminished, the drumming rain on the roof slackened off. Neither Tim nor Hawk budged an inch, though. Not until it became completely quiet out there.

"Do you think it's over?" Tim whispered.

Hawk shook his head. "Maybe."

They heard a bird chirping outside.

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Hawk scrambled to his feet and went to the window on the other side of the Prof's bed. He eased the shutter open a crack, then flung it all the way back. Bright sunshine streamed into the room. Tim noticed a trickle of water that had leaked through the window and its shutter, dripping down the wall to make a puddle on the bare wooden floor.

The Prof seemed to be sleeping soundly, but as they tiptoed out of the bedroom, he opened one eye and said, "Check outside. See what damage it's done."

A big pine had fallen across the house's low roof; that had been the crash they'd heard. The water pipe from the cistern was broken, but the cistern itself—dug into the ground—was unharmed except for a lot of leaves and debris that had been blown into it.

The next morning the Prof felt strong enough to get up, and he led the boys on a more detailed inspection tour. The solar panels were caked with dirt and leaves, but otherwise unhurt. The boys set to cleaning them while the Prof mended the broken water pipe.

By nightfall the damage had been repaired and the house was back to normal. But not the Prof. He moved slowly, painfully, his breathing was labored. He was sick, even Tim could see that.

"Back in the old days," he said in a rasping whisper over the dinner table, "I'd go to the local clinic and get some pills to lower my blood pressure. Or an EGF injection to grow new arteries." He shook his head sadly. "Now I can only sit around like an old man waiting to die."

The boys couldn't leave him, not in his weakened condition. Besides, the Prof said they'd be better off waiting until the spring tornado season was over.

"No guarantee you won't run into a twister during the summer, of course," he told them. "But it's safer if you wait a bit."

He taught them as much as he could about his computers and the electrical systems he'd rigged to power the house. Tim knew how to read some, so the Prof gave him books while he began to teach Hawk about reading and writing.

"The memory of the human race is in these books," he said, almost every day. "What's left of it, that is."

The boys worked his little vegetable patch and picked berries and hunted down game while the Prof stayed at home, too weak to exert himself. He showed the boys how to use his high-powered crossbow and Tim bagged a young boar all by himself.

One morning well into the summertime, the Prof couldn't get out of his bed. Tim saw that his face was gray and soaked in sweat, his breathing rapid and shallow. He seemed to be in great pain.

He looked up at the boys and tried to smile. "I guess I'm . . . going to become immortal . . . the old-fashioned way."

Hawk swallowed hard and Tim could see he was fighting to hold back tears.

"Nothing you can do . . . for me," the Prof said, his voice so weak that Tim had to bend over him to hear it.

"Just rest," Tim said. "You rest up and you'll get better."

"Not likely."

Neither boy knew what else to say, what else to do.

"I bequeath my island to you two," the Prof whispered. "It's all yours, boys."

Hawk nodded.

"But you . . . you really ought to warn . . . your people," he gasped, "about the ice . . ."

He closed his eyes. His labored breathing stopped.

That evening, after they had buried the Prof, Tim asked Hawk, "Do you think we oughtta go back and tell our folks?"

Hawk snapped, "No."

"But the Prof said—"

"He was a crazy old man. We go back home and all we'll get is a whippin' for runnin' away."

"But we oughtta tell them," Tim insisted. "Warn them."

"About something that ain't gonna

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happen until we're grandfathers? Something that probably won't happen at all?"

"But—"

"We got a good place here. The crazy old coot left it to us and we'd be fools to leave it."

"What about Colorado?"

"We'll get there next year. Or maybe the year after. And if we don't like it there we can always come back here."

For the first time in his life, Tim not only felt that Hawk was wrong, but he decided to do something about it.

"Okay," he said. "You stay. I'm goin' back."

"You're as crazy as he was!"

"I'll come back here. I'm just goin' to warn them and then I'll come back."

Hawk made a snorting noise. "If they leave any skin on your hide."

For a week Tim patched up their boat and its ragged sail and filled it with provisions. The morning he was set to cast off, Hawk came to the pebbly beach with him.

"I guess this is goodbye for a while," Tim said.

"Don't be a dumbbell," Hawk groused. "I'm goin' with you."

Tim felt a rush of joy. "You are?"

"You'd get yourself lost out there. Some sea monster would have you for lunch."

"We can always come back here again," Tim said, grunting, as they pushed the boat into the water.

"Yeah, sure."

"We hafta warn them, Hawk. We just hafta."

"Shut up and haul out the sail."

For several days they sailed north and east, back along the way they had come. The weather was sultry, the Sun blazing like molten iron out of a cloudless sky.

"Ice age," Hawk grumbled. "Craziest thing I ever heard."

"I saw pictures of it in the books the Prof had," said Tim. "Big sheets of ice covering everything."

Hawk just shook his head and spit over the side.

"It really happened, Hawk."

"The weather don't change," Hawk snapped. "It's the same every year. Hot in the summer, cool in the winter. You ever known anything else?"

"No," Tim admitted.

"You ever seen ice, except in the Prof's pictures?"

"No."

"Or that stuff he called snow?"

"Never."

"We oughtta turn this boat around and head back to the island."

Tim almost agreed. But he saw that Hawk made no motion to change their course. He was talking one way but acting the other.

They fell silent. Tim understood Hawk's resentment. Probably nobody would listen to them when they got home. The elders would be pretty mad about the two of them running off and they wouldn't listen to a word the boys had to say.

For hours they skimmed along, the only sound the gusting of the hot southerly wind and the hiss of the boat cutting through the placid water.

"It's all fairy tales," Hawk grumbled, as much to himself as to Tim. "Stories they make up to scare the kids. What do they call 'em?"

"Myths," said Tim.

"Myths, that's right. Myths." But suddenly he jerked to attention. "Hey, what's that?"

Tim saw he was looking down into the water. He came over to Hawk's side of the boat.

Something was glittering down below the surface. Something big.

Tim heart started racing. "A sea monster?"

Hawk shook his head impatiently. "I don't think it's moving. Leastways it's not following after us. Look, it's falling behind."

They lapsed into silence again. Tim felt uncomfortable. He didn't like it when Hawk was sore at him.

Apologetically, he said, "Maybe you're

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right. The old man was most likely a little crazy."

"A *lot* crazy," Hawk said. "And we're just as crazy as he was. The weather don't change like that. It's just not possible. There never was a Flood. The world's always been like this. Always."

Tim was shocked. "No Flood?"

"It's one of them myths," Hawk insisted. "Like sea monsters. Ain't no such thing."

"Then what did we see back there?"

"I dunno. But it wasn't no sea monster. And the weather don't change the way the Prof said it's goin' to. There wasn't any Flood and there sure ain't goin' to be any ice age."

Tim wondered if Hawk was right, as their boat sailed on and the broken stainless steel stump of St. Louis' Gateway Arch fell farther and farther behind them. ■

Editorial *(Continued from page 8)*

That has always been, and will remain, to please our readers by exploring new territory of ideas.

This special anniversary/millennium issue showcases a wide range of work by writers and artists who have been associated with the magazine during all parts of its history. Kelly Freas, often called "the dean of science fiction illustrators," starts us off with his dramatic cover. That, in turn, illustrates "Under," a new story by Hal Clement ("the dean of hard science fiction writers"), set on Mesklin, one of the most famous and exotic science-fictional worlds ever created. At the other end of the spectrum we have Michael A. Burstein, a quite recent winner of the John W. Campbell Award for Best New Writer. In between are offerings by a diversity of writers of all ages, including Larry Niven, David Brin, and the highly respected former editor Ben Bova. Mike Resnick gives us a tongue-in-cheek look at just how far our field has come, in some respects; and Jack Williamson, the only living writer associated with the magazine in every decade of its history, shares a personal reminiscence about his astounding career.

And what about the next millennium, or even the next century? I will venture only two predictions. First, they will change even more, by dramatic margins, than the ones just completed. Despite the silliness we often hear about "the beer of the millennium" or "what life will be like in the twenty-first century or the third millennium," all we can say with real confidence is that those questions are essentially meaningless, because life is going to change beyond even our best efforts at imagining. The year 2000 will, even if Y2K goes off even more smoothly than the most optimistic projections, be more like 1900 than it will be like 2100. And 3000 will, in all probability, be more different than anybody can imagine in . . . well, in a thousand years.

But my second prediction is that *Analog* will still be trying to imagine the possibilities. After Apollo, those who didn't know any better asked, "What is left to say about space?" After Dolly, those who didn't know any better said, "Well, that's the end of clone stories." But, as I predicted, we soon began seeing a rash of brand new ones, some of them exploring whole new realms of possibility opened up by the real world's reactions to what was happening. I don't see any end to that, and I anticipate that this magazine will continue to play a leading role in thinking about what lies ahead. Its physical form may change radically, and a lot of the writers will be new (maybe *you* will be one of them, for we're always seeking new talent), but we're not going to run out of material any time soon! ■

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THE GRAND DECOMPOSITOR: THE JOB OF THE FUTURE

(Editor's Note—This is an "Alternate Alternate View." As Jeffery D. Kooistra indicated at the end of his last column, he is taking this month off because of the demands on his time associated with a major move and job change. He'll be back, but for now, Rick Cook, a writer familiar to *Analog* readers and quite adept with Alternate views in his own right, has kindly agreed to fill in.)

In *Beyond This Horizon* Robert Heinlein identified the job of the future as "encyclopaedic synthesist"—someone who could absorb knowledge from many different fields and meld it to produce new insights.

Personally I find the job of Know-it-All-In-Chief extremely attractive, and I suspect both Heinlein himself and a lot of his readers do as well. However the more I think about it, the more I think Heinlein got it wrong.

Attractive as the notion of an encyclopaedic synthesist is, it goes against the fundamental grain of the way humans accumulate and use knowledge. We're social animals who work best in groups.

Most of our advances in knowledge have come from a combination of specialization and cooperation. An Einstein or a Newton develops a fundamental insight and then legions of scientists, engineers, and ordinary people develop and refine it and turn it into things that are useful.

There's certainly a problem of becoming too specialized so that knowledge from different areas isn't being combined and used effectively. That's one of the reasons *Analog* runs fact articles; to provide cross-pollination. However, better communication is probably a better way of handling the problem than trying to create a new breed of metaspecialist.

The Internet is a case in point. The Internet, and its mutant offspring the World Wide Web, are coming ever closer to meeting the ideal of making all the world's knowledge available to anyone who wants it. Already the volume of information out there is astounding. Better yet, a lot of it is written as tutorials to explain whatever it is to nonspecialists. And best of all, the Internet and the Web serve as locator services for experts in nearly anything you can think of. You may not know the answer but you can find someone who does by hitting the Web or the Internet newsgroups.

There are still a lot of problems with the Internet as a source of information. For one thing the search facilities are lousy. Even the most sophisticated search engines aren't very sophisticated and you waste a lot of time wading through stuff you're not interested in. Worse, if you can't think of the magic words or phrases people have used, you often don't find anything. And if the volume of information is astounding, the

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volume of junk, misinformation, pornography, weird political tracts and other stuff is even more astounding.

Still, I think the principle is clear. While we will undoubtedly have people who are especially good synthesists, most of us will do our own synthesizing with the help of knowledge stored on-line.

So what will be the job of the future? On reflection, I think Heinlein got it backwards. The job of the future will not be combining things, it will be breaking things apart.

What led to this insight was Linux. As a frequent writer about Linux topics, and as a columnist for the online magazine LinuxWorld, I think a lot about Linux these days. It's a very interesting thing to think about, too.

Linux is a clone of the Unix operating system. What's different about it is the way it was made.

Linux wasn't done by a company. It started as the personal project of a student in Finland named Linus Torvalds (hence "Linux") and was perfected by a group of volunteers all over the world tied together by the Internet. Linus remains in overall control, and there are teams working on specific areas, but anyone is free to contribute. Kind of software stone soup.

When a new feature or utility is developed for Linux, it is released and what follows is a Darwinian winnowing-out process. People make suggestions, improvements, or come up with complete new versions of the feature or utility. Eventually something emerges that combines the best features of the candidates and becomes the standard piece of software for doing that job.

Linux itself is taking the computing world by storm. Tens of thousands of people are installing this free operating system on their computers, in many cases replacing Microsoft Windows. Which is nifty, but for my purposes the Open Source model, under which Linux was developed, is even more interesting.

Open Source is a concept that owes its present incarnation to a computer scientist named Richard Stallman. Stallman believes that software should be open and freely available and to put his money where his mouth is, Stallman and a large group of like-minded individuals created the GNU project to develop and distribute free software. (GNU stands for GNU is Not Unix, an example of recursive naming and programmer humor.) One of the things the GNU project developed as the Open Source software license, sometimes called "copyleft." The idea is simple. You can use the software, and distribute it to anyone free. But you must include the source code (the human readable program) with the distribution. And if you modify the program in any way you have to distribute the source code to your modifications.

Intentionally or not, Open Source has created a whole new way of developing software. It affects not just the software, but the process by which the work of creating it is done. A successful Open Source project is near-perfect example of Anarchy in action.

Anarchy (big-A. The small-a version of anarchy is something else again) replaces formal structure with voluntary cooperation. As a political theory it is somewhat deader than a doornail—an object so dead 99 people out of a hundred can't even tell you what a doornail was. The problems of replacing government, business and everything else with a network of voluntarily cooperating enterprises is seen as insurmountable and the nineteenth-century Anarchists didn't help their case by trying to substitute assassination for party politics.

But while Anarchy presents insurmountable problems for governing a society, it is one of the best systems ever developed for getting the absolute best out of a group of talented, motivated people.

And that's an increasing problem. More and more the old ways of motivating people are failing to meet the needs

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of our post-industrial society because increasingly we need not merely performance, but superb performance if we are to compete and continue to make life better for everyone.

Slavery doesn't work. It's economically inefficient because (among many other reasons) the productivity is low and the quality of output is lousy. You can get gangs of slaves to pick cotton, but you can pick a lot more cotton a lot cheaper with a modern cotton picking machine. But you can't build cotton pickers with slave labor, not if you want to be competitive.

The old industrial system has weaknesses as well. In the old days the primary motivators of workers were money and fear. If you were good you got paid and if you were bad you got fired. The problem with those motivators is that they don't work all that well. You can get a functioning assembly line that way but you don't get a highly motivated, competitive work force.

Leaving aside some changes on the industrial system, that brings us to an Open Source project. The key person in an Open Source project is the project leader. This usually self-appointed individual is the dictator who makes the key decisions for the project. Typically the project leader is backed up by volunteer programmers who support the project by writing code. Each one usually writes just a section of the program and the project leader makes sure they are combined into something useful.

Of course like most absolute monarchs, the project leader isn't free to do anything he or she wants. Not if she wants the project to succeed, anyway. The project leader has to convince people to work on the project and this tends to be a self-reinforcing proposition.

If the project leader doesn't succeed, one of two things happens. The project either dies or someone else picks up the idea, appoints himself/herself project leader of a new team, and makes another run at it. It is not unknown to have two or three groups working on the same idea.

So if you're the project leader, you have to keep the troops working. But by traditional standards you're extremely limited in the methods you can employ. You can't threaten to fire anyone because you never hired them in the first place. You can't offer them more money because there isn't any. You don't even have the Silicon Valley equivalent of money—stock options—to sling around. Basically you only have two things you can reward people with to keep them working on the project.

One of those things is recognition. The people who worked on Open Source software have their names on the product. They become known to their peers in the programming community and if they've done good work they're admired for it. Recognition of this sort is a very powerful drug where human beings are concerned. (It is, for example, the main reason I'm writing this column. *Analog* pays quite well by science fiction standards, but it's a lot less than the computer magazines I usually write for. On the other hand, I didn't grow up reading computer magazines.)

Science fiction fandom, which is almost completely run by volunteers, has recognized this principle for decades. In SF terms it is called "ego-boo" and it is a great motivator for people who publish fanzines, run science fiction conventions and such.

The second great motivator in the Open Source community is the Pinball Effect. Basically creative endeavors, whether writing novels, painting pictures or developing software are like playing pinball. The reward for doing it well is the chance to do it again. Or, as the techies put it, the chance to work on something "interesting." The most important way a project leader attracts a team is by giving them something interesting to work on. That means a piece of work large enough to be intrinsically

(Continued on page 181)

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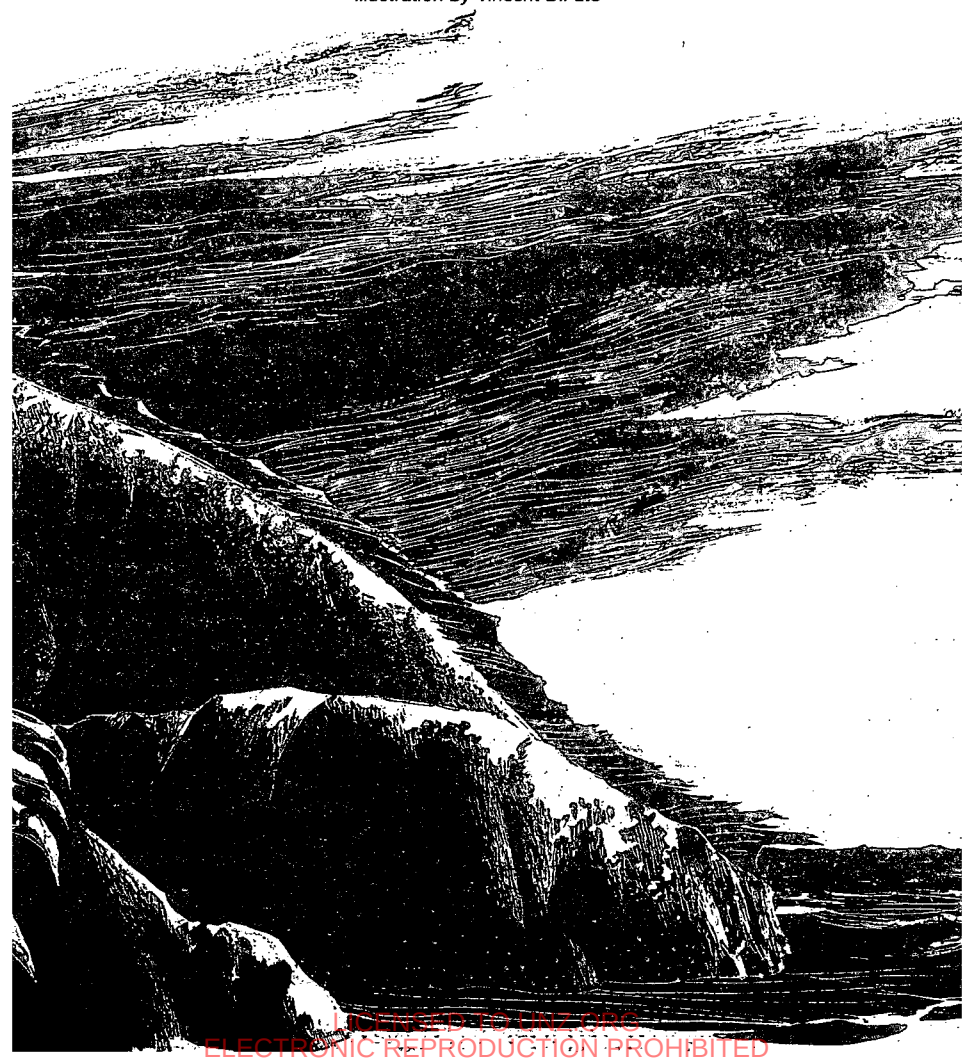
Larry Niven

LOKI

We all owe a lot to our forebears,
some of whom may not be exactly ancestors
in the traditional sense. . . .

Illustration by Vincent DiFate



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As long ago as our memory runs, the witch wagon came crawling down out of the rippling silver sky. She brought a taste of chemicals and metals, but that went away over a crawler's generation. That was eighty generations ago.

Generations were shorter then. We were less careful at counting, too. Life changed rarely. Change came as disaster, as altered deep sea currents, hordes of predators, water fouled by algae blooms. Only survival mattered then. Recording our history was not a high priority, before the witch wagon came.

The top of the witch wagon was a window to light and color, visible from any side. From above it was only a silver circle. The box underneath made sounds. She moved a little like a great angular snail. We hid from her for a time, but she never harmed any swimming or crawling thing.

She didn't eat. We thought she might be a free-moving plant, but she could not be eaten either

Our oldest tales have been forgotten because they relied on memory. Teacher thought that we remembered what our ancestors had known, but that is not right. It is as if tracks were grooved in our minds before birth, so that we can more easily be taught what our ancestors knew.

We remember when the witch wagon came, but these early tales are vague. They were scrawled in sand and the pictures remembered from generation to generation.

The pictures she showed could be brilliant abstracts: black scattered with white and color-tinged dots and arabesques, green seabottoms shining as if a hotter sun were blazing just above the sky, or waters with far stranger creatures than ourselves. But the witch wagon learned to draw simpler sketches when she talked to us. The simplified pictures in the witch wagon's display window showed us that we could draw what we were shown. One of us must have thought of adding symbols for the sounds she thought went with the pictures.

There were no artists before the witch wagon.

The stories we crawlers tell are rich in detail, all sound and chemical cues and rippling fins and manipulators and the colors in our skins. But none of our language was made to describe anything so strange as what the witch wagon had to tell. Language did not have enough senses to play with. The witch wagon had far less, only pictures and sound. We took it for talk and tried to talk back.

We learned to draw in the sand where the sky is close and daylight pours through. Later tales were carved with the flint daggers the witch wagon taught us to make. We carved them wherever we could find vertical rock, and copied them before they faded.

Some of what she taught seemed nonsense.

Geometry was a matter of rigid shapes to hold and manipulate in one's mind, shapes made of straight lines and flat planes. There are no such shapes in our world! Rigid rock did poke through the soft land, or billowed up in boiling seawater and cooled into soft-looking pillow shapes that were hard to the touch. The shell of a dead dustman crab was hard and rigid. But nowhere were there straight lines or flat surfaces. None of us could understand. The witch wagon gave up on geometry.

But some lessons stuck.

Things need names, consistent names, and for more than poetry. Related things should have related names. Snark, leviathan, anvil jungle, dustman crab, crawler (ourselves): If we can name a thing's ***kind***, we are a step toward understanding it.

Leviathan is huge, unstoppable, but slow to turn. Snarks are fast and agile. One could escape a snark by diving into an anvil jungle. A leviathan would just crash through and eat what flew out.

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Dustman crabs were not to be killed: they kept the environment clean even when the currents were quiet.

She told us of Teacher.

The witch wagon was the moving part of a larger entity. Her larger part . . . her mind . . . was above the silver sky, dry, where she could live a long time. The witch wagon was like a voice and hand turned loose to roam: Teacher's hand and voice, but tenuously connected, and stupid as a lost voice might be. She could crawl about where the sand was flat. Teacher could only squat where she fell, where the land poked through the sky, two days' crawl from where we then made our home.

We had been wanderers. Now too many of us gathered around the witch wagon, and stayed. We studied the witch wagon, and she studied us, for no more than seven generations. Then predators swam into our range and drove us away.

For twenty generations we dared not go near where the witch wagon must lie.

There was no way to lose that place. Where else did the land poke above the sky? We know four such places now—islands—but in that age, only one. It was twenty daywalks distant and it seethed with snarks, leviathan, and a new predator we named *tractor crab*. The witch wagon lay a day's crawl sunsetward of the island. We never forgot.

Now we had nothing but memory and stories and speculation, and the flint daggers we used to carve rock.

We learned to fight with the daggers.

We'd given up on geometry, but we remembered that rigid things could be useful. We could tow rocks. Volcanic pillows are rigid after they cool, and porous: we could shape such stuff into refuges, imitating the hermit crab. We built barricade walls that would tear a leviathan's belly if it swooped to take one of us. We hunted the snarks from inside the barricades.

Our numbers grew. We took our territory back. We won our way to what had become half a memory, a children's tale, a metaphor, a myth. Back to the witch wagon.

The witch wagon waited, moving only when the mud had settled too thickly. Still, she paid a price in twenty generations of corrosion.

She showed us how to mount shards of flint on leviathan whiskers, for better weapons. We were taught how to fight in numbers, as a geometrical array. We did not die as prey any longer. We died battling what preyed on us. But some died in the enemy's teeth, and some died from exhaustion.

Then the witch wagon couldn't move any longer, and her ring of display window darkened and blurred. One day we saw nothing but a dulled silver cylinder.

Our language became sound alone, except that the witch wagon could see the pictures we drew. We grew better at talking, better at learning. In another ten generations we learned enough to change our kind forever. Our barricades were cities. There was not enough pillow lava to make our houses. Anyone could see that our numbers were grown too great; and then one of us saw the answer.

Civilization is partly what the witch wagon taught us. But how can we know what part? Think upon this matter of our numbers. The witch wagon told us that our tiny males who live in a crease behind the chin and are fed by dribblings from our mouths, reminded her of *sperm*, of the male-seed of her kind. Another time she told us how sperm could be blocked from a parent. We saw the point: we need only kill all the males until our numbers are as they should be, then let them swarm again. But did Teacher think of that, or did we?

Counting generations used to be diffi-

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cult, before we learned how to control our numbers.

She taught us things . . . but some things we learned because she taught us how to learn.

The witch wagon told us how to breed the life around us for traits we liked. We thinned the seaweed forests to be less benign to the snarks, while still housing the life that fed us. When leviathans were too rare to threaten us, we began shaping them too.

The witch wagon told us of worlds beyond our worlds, seen as white points on black, but only from above the sky. She told us of melted sand lenses that bend light but do not stop it, and how they can make the white points look larger. But she could not tell us how to make lenses out of sand.

But did she tell us to breed the high and low transparent jellyfish, to make our own telescopes and see the stars?

My parent is sure that Teacher was not crazy enough for that. Whatever madness our ancestors thought they'd found in her, her teachings proved out. Teacher never feels madness, divine or mundane. I've come to agree.

The witch wagon's voice grew rusty and stopped, thirty-eight generations before my own birth.

Teacher lived above the silver sky. Again we had to build from what we had learned; and again we knew our destiny, and never forgot.

After the witch wagon's voice stopped, we might perceive the next thirty-eight generations—long generations, because of what we have learned—as only my seabottom-crawling kind learning how to reach Teacher.

We bred jellyfish as telescopes. The view grew clearer with each generation. Faith was not needed here. What we saw through them was no illusion: we saw sea birds as well as stars!

We destroyed the snarks that killed leviathans, and bred the leviathans for what we wanted, but that was hard. Leviathans live three generations. We had to invent governments stable over many lifetimes. But we did that.

Ultimately we butchered leviathans for their flotation bladders, and filled them with water, and rolled up onto the land. Six generations ago our land rollers came out of the water to see Teacher face to face.

Two among those were my ancestors.

The witch wagon had told us of the world above the silver sky. Teacher spent effort analyzing what grew near her, and relayed what she knew to the witch wagon, though the relay failed early on.

We live through air dissolved in water. No walkers can survive on air alone, certainly no swimmer can, but some plants can grow above the sky. Endless generations of us have known how to find that strange place, how to find Teacher; but not how to survive up there. Teacher told us how her kind goes into worlds even less hospitable, into *vacuum*, wearing balloons made in the shape of her kind, that carry what they need. We have done the same. Gradually we get better at it.

Teacher looks like a rounded rock.

"This shape took me through the air without burning up," she said. "Motion is heat, and my voyage involved faster motion than I can easily describe." She would have demonstrated: "Put a pebble in this attitude jet, this hole under my spotlight. One blast and I'll send it clear across the island!"

But my four-mother had no way to move a pebble. Even so, her balloon was much improved over her two-mother's. Those first air rollers nearly died when the water in their balloons went stale.

The balloons hold what we need: not air, but water. We learned to bubble air through it; there must be air in our water, or we die; but not too much, or we die. We learned to move the balloon by walking along its bottom, using our

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weight. It works better if we carry rocks.

In three generations we had a permanent base, an inland pond pointed out by Teacher and filled with seawater we carried in bladders. Underwater we built temporary homes, and pressure refuges too, because rain changes the composition of seawater.

Teacher's voice carries not through thin air but through the rock. We began to learn again.

Teacher is the payload of an interstellar probe. Teacher was once far more powerful: one component of a personality greatly more complex than our own brains. The probe split to perform varied functions, a monotheistic God become a pantheon. There is an orbiter (moving so high and fast that it cannot fall) and a wanderer among the nearby worlds. Teacher is the lander. She was made to talk to whatever she found.

We must still take a good deal of this on faith.

"There are worlds like my world," Teacher told us, "covered three-quarters with water. Life shapes itself in water and eventually wants the land too. But many worlds have too much water, just as some have too much air and some have too little of both. Your world is nearly all water. There's so little land that few living things want it."

"Why should we?" my three-mother asked.

"You've been building a civilization, but there are things you cannot build in water," Teacher said. "But you can't reach out of it, can you? How can you manipulate anything?"

"How do you?" we asked, and we listened to her answers.

I was born for this, trained for this. I was to be a land roller, whatever that might mean when I became mature. If we breed ourselves for special traits—as we do, but very cautiously—then I was bred not to fear the blinding sun or the dry air. So, I do not.

We were not sure what would work. Whatever we tried, some died. Whatever we tried, we became more capable.

This worked: a leviathan altered by radiation, genetic tampering, then natural selection.

I ride out of the sea where all before me walked. Leviathan hunches itself across the rocks, using stronger, thicker fins than its ancestors had. The skin of its back is thick, horny, armored against the sun. It still carries its bladder, but filled with water now, and the bladder protrudes through the beast's skin below its chin. Three of us ride inside. The view is a bit murky, a bit distorted.

I see our inland base below me. Tear this bladder apart and we might wriggle to safety through the thin air. We have reached the highest point of the island, and Teacher.

"I could not see how you would reach me," Teacher said. "You have gone beyond me. I can make out your cities even from here, when the waves slacken. Still there are things I can teach. That plant in my spotlight, can you tear it up?" A tiny brilliant green dot blazes in a clump of dry-living plants. Raw daylight changes its color.

My companion manipulates nerve clumps. These land-based plants are tough, but Leviathan rips up a stalk thrice my length.

"It needs to dry," Teacher said. "Pull it to the top of that rock slope. Fetch seven or eight more. We'll see if the stuff is dry tomorrow. Then, can you recognize flint when it dries?"

The tiny green dot probes out. "That's flint. Pick up two chunks. Bigger." Twice the size of my head, these. I rap them against each other.

Teacher says, "You're not making knives now. Now we wait a day and hope it doesn't rain."

All the long generations have come to this. I asked, "What then?"

"Then I will teach you fire." ■

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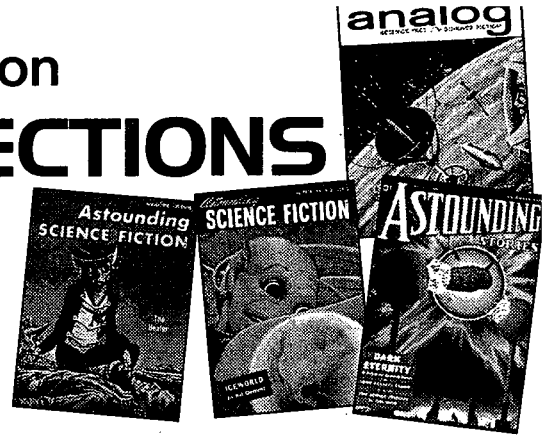
Jack Williamson

RECOLLECTIONS OF ANALOG



Analog was born in 1929, the year Hugo Gernsback invented the term "science fiction." First called *Astounding Stories of Super-Science* (the initial issue dated January, 1930), it began as a luridly unbelievable pulp adventure magazine, with no pretensions to literary value or intellectual interest. The birth was almost an accident, and a lucky one for me.

Harry Bates tells the story of it in the opening section of *A Requiem for Astounding*, by Alva Rogers. Published nearly forty years ago, the book is a fan's history of the magazine through its first three decades, when it led the field. Rereading it was for me a nostalgic time trip back through almost forgotten times. With no aspirations to critical scholarship, Rogers recalls the emotional impact the magazine had on me and many others like me.

The pulps, generally aimed at special-interest groups, had small circulations as compared to such giant slicks as the *Colliers* and the *Saturday Evening Post*. For economies of scale, they were published in chains of many different titles. Pulp paper was cheap, but the covers were on expensive coated stock. *Astounding* came about when William Clayton, owner of the Clayton chain, noticed that his odd number of titles left the printer wasting costly paper on blank covers. He asked Bates, one of his editors, to fill the gap with a new magazine. Bates, who had seen the success of Hugo Gernsback's science fiction ventures, came up with *Astounding*.

I had discovered science only a few years earlier, in the classics of Wells and Verne and Poe, and the more recent romances of Edgar Rice Burroughs and A. Merritt, reprinted in Gernsback's *Amazing Stories*. They lifted me out of a drought-stricken New Mexico farm, where I had no visible future, into a world of dazzling wonders: space flight and atomic energy, computers and television, genetic engineering and miraculous medicine. All of them were then still the stuff of science fiction, imagined possibilities still bathed in glowing clouds of utopian anticipation, not yet grimed with gritty reality.

It was that vision of exciting new technologies and the bright tomorrows they might create that gave us the "sense of wonder" veteran fans lament with such nostalgia. It made us the unhonored prophets of a new faith, lonely pioneers in a world of critical unbelievers bewildered by the term "science fiction." Fellow fans were rare, and we found one another with feelings of instant kinship.

A college sophomore in 1930, I had been captured completely. Setting out to major in chemistry, I was already dreaming of a career in science fiction. Hammering a Remington portable typewriter in every spare moment, I was immensely elated by every sale to Gernsback, though he paid only half a cent a word, even that slow to come. That summer, back at home on the farm, I

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wrote three stories and mailed them to Clayton. He bought two of them at two cents a word, a fortune for me in those Depression days.

Bates cared nothing for science or writing style, but he understood pulp fiction. The pulps deserve a good word. Seldom great literature, they were a great school that could pay the novice such as I was while he learned the craft. Written to entertain, a good pulp story had a strong hero, in the action pulps a male hero. He had some admirable goal. He was portrayed through a plot that had a beginning, a middle, and an end. He solved his problems himself, and commonly won the girl.

A competent editor and paying enough to attract such stars as Ray Cummings, Bates improved upon that disappointing first issue. He himself was a competent pulpster. Writing as Anthony Gilmore in a secret collaboration with Desmond Hall, an assistant editor, he became one of his most popular authors. Their hero was Hawk Carse, an invincible space desperado ranging through the solar system to battle the evil schemes of an Oriental villain, Dr. Ku Sui. I think the stories were sold to Clayton though literary agent Charles Roy Cox.

Though I never met Bates, he bought more stories till the Clayton chain went bankrupt, a financial disaster for me. Publication of *Astounding* was suspended for six months, until it was bought by Street and Smith, an older and more powerful pulp empire which had its own presses in an old and fondly recalled red-brick building at 79 Seventh Avenue. I believe the title was picked up at auction, for twenty-five dollars.

I recall a cheering handwritten note from Desmond Hall, asking for submissions to what was now simply *Astounding Stories*. The new editor was F. Orlin Tremaine, who kept the job until John W. Campbell took over. Though he offered only one cent a word, I was eager enough to sell for that. At first he bought only shorts. When he decided to use serials, I had one on hand, "The Legion of Space," which had been turned down by *Argosy*, the great pulp that had run the serials of Burroughs and Merritt.

Tremaine cared no more than Bates about actual science, but he had wider horizons. He reprinted Charles Fort's accounts of unexplained phenomena. He asked for "thought variant" stories, meant to stretch the pulp envelope. Nat Schachner's "Ancestral Voices" was the first; I wrote the second, "Born of the Sun." He attracted writers who carried *Analog* to the top of the field. "Doc" E. E. Smith and John W. Campbell were the stars. Beginning with epic space wars fought with ever-larger battle craft and ever more fantastic superscientific weapons, they went on to better things. Doc wrote "Skylark of Valeron" and later the "Lensman" series. Campbell became Don A. Stuart. Issac Asimov, still a fan, listed the two of them as his favorites, and made me happy when he placed me third.

I got on well with Tremaine. He took me to lunch on my first trip to New York, asked me to write another "Legion" serial, "The Cometeers," and bought more stories till Campbell took his place in 1938. Later, he wanted me to write another space epic for *Comet*, his new magazine, but inspiration failed me then.

Campbell changed the name to *Analog* in 1960, and kept the editorial post until his death in 1971. With a physics degree from Duke, he knew and cared more about science than Bates or Tremaine. Just younger than I, he had caught the same half-mystic vision of splendid possible worlds to come. Human worlds, for him; at home in Asimov's future human universe, he never wanted superior aliens. His story ideas could be exciting, and he shared his ideas freely with contributors. Listening to his nonstop talk, when now and then I spent a weekend at his New Jersey home, was for me a fascinating but exhausting experience.

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He was almost a collaborator on my "seetee" stories, which I believe were the first fiction about antimatter. I had proposed a series about the planetary engineers, who would terraform new worlds for human use. He suggested that some of them would be antimatter, then only far-out speculation and called contraterrene, which he abbreviated to CT. I had never heard of it, and he instructed me in the theory.

At the time, I had stalled on a planned serial that Jim Gunn and I later finished in collaboration as *Starbridge*. He suggested that I invent a new pen name and a new writing style as he had done with Don A. Stuart—a name adapted from his wife's, Dona Stuart. We had both admired the style of C. S. Scoggins in the serials he wrote for the *Saturday Evening Post*. I borrowed my own middle name to become Will Stewart for the series of stories that became *Seetee Ship* and *Seetee Shock*.

The first dozen years of his editorship have been celebrated as "the golden age of science fiction." He recruited Robert Heinlein, Theodore Sturgeon, A. E. van Vogt, L. Sprague de Camp, Lester del Rey, Isaac Asimov, and many others with imagination and future visions of their own. And he kept a few old-timers in his stable, among them Clifford Simak and myself. After H. G. Wells, Campbell and Heinlein deserve credit as the chief architects of modern science fiction.

An Annapolis graduate, Heinlein knew science enough. He cared about our future and shared Campbell's fascination with possible new technologies that might fill it with exciting promises and daunting challenges—great story material. That vision is outlined best, I think, in the juvenile novels he wrote for Scribners after he parted ways with Campbell. Beginning with two boys building a backyard rocket in *Rocket Ship Galileo*, it ends in *Have Spacesuit, Will Travel* with the youthful hero negotiating with the lords of the three galaxies for the recognition of human civilization.

I was living in Los Angeles when his career began. He knew my work and became a friend. I spent many evenings with him and Leslyn in their home at the informal talkfests he called "the Mañana Literary Society." His mind was perhaps the most expansive I have ever encountered. I learned from him and what he used to say about his works in progress.

That memorable interlude ended with Pearl Harbor. I remember calling Heinlein with the news when I heard it on the radio that Sunday morning. The war interrupted everything. I next saw him in Philadelphia in 1944 a few months before I went overseas as an Air Corps weather forecaster. The date, from Asimov's autobiography, was Saturday, December 2. He and Heinlein were there at the Navy Yard as civilian employees. Sprague De Camp was an officer. L. Ron Hubbard turned up at the party, dropping mysterious hints of naval action in the North Pacific that he wasn't free to talk about.

A reunion of *Analog* veterans. Asimov has written of his apprentice days, when he used to ride the subway to the old Street and Smith building to bring his manuscripts to Campbell, listen to his comment and criticism, and go away with ideas for another such story as "Nightfall." My own friendship with him dates from 1939. On January 2, as he writes in his diary, he received a postcard from me with congratulations on his first sale. While I was in New York that summer, he came to see me in my room at the Sloan House YMCA. He introduced me to the Futurians, among them Don Wollheim, Cyril Kornbluth, and Fred Pohl, still fans then but later major names. Fred was later a fellow weather man, my agent, my editor, a collaborator on many novels.

Heinlein wrote no more for Campbell after the war. He was publishing successful books and selling short stories to the slick magazines for better rates than *Analog*'s. And they had different philosophies. Campbell was politically

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conservative. He let Kay Tarrant, his assistant, prune manuscripts of anything she considered suggestive; George O. Smith boasted of getting past her with a reference to a "ball-bearing mousetrap" (a tomcat). Heinlein, I think, would have been a Libertarian today. With *Stranger in a Strange Land*, he was pioneering the sexual revolution of the 1960s.

Back from the Northern Solomons after the war, I found the world changed, and science fiction with it. The mushroom cloud over Hiroshima marking the end of the age of wonder, our golden dreams were turning to thorny reality. To the postwar generation, haunted with nightmares of nuclear holocaust, Campbell's guiding vision of a magnificent galactic future for mankind had fallen sadly out of date.

Science fiction, of course, did survive and prosper, but with its optimistic visions turning sour. Cinema discovered it, with anti-science films about disasters set off by reckless probers into secrets "man was not meant to know." Book markets opened as nostalgic fans founded new presses to reprint the serial novels they had loved. Major publishers saw their success and put them out of business.

With able new writers reaching millions of new readers, science fiction under its American label was breaking at last out of the pulp ghetto where it was born and spreading around the world. Diversified into a thousand shapes to fit that wider audience and losing much of its old concern with actual science or serious speculation, it was finally finding its long-coveted place in the mainstream, but most commonly known as "sci-fi."

The space age was born out of science fiction. With a nod to Goddard and Tsiolkovski, it grew out of the fiction and non-fiction of such rocket fans as Willy Ley, published in the science fiction magazines back when more sober editors were still convinced that rockets would never fly in space without air to push against. G. Harry Stine, who worked at the White Sands Missile Range and wrote fiction as Lee Correy, invited Heinlein and me down to watch the test firing of the last of the captured V-2 rockets. Designed by those early dreamers of the conquest of space, they were the first true spacecraft but also the first ballistic missiles.

Adjusting to those cold new realities was a little difficult for me. My first project after the war was a novel about technology carried too far. Asimov's robots, famous for their three restraining laws, are benign personifications of human reason. My own humanoids, their prime directive even more benign, suffocate mankind under total care. I tried to write then into a traditional pulp story of their defeat by better technology, and gave it up when I realized that the story premise made their benevolent tyranny invincible.

For relief, I wrote "The Equalizer," an optimistic pre-Libertarian dream of mankind set free from a more traditional tyranny by another new technology. Liberated myself, I returned to the humanoids in "With Folded Hands," a darkly dystopian novelette of individual privacy and freedom gone forever—my best work.

Campbell bought both stories, but that dark conclusion ran against his vision of future human supremacy. A convert of Joseph Rhine, he asked me for a sequel in which human beings, unable to use their hands, would evolve new mental powers and free themselves. That sequel became *The Humanoids*, my most successful work. To placate him, while the humanoids are still invincible, I wrote an ending in which the robots themselves invent the paraphysical powers and brainwash the human rebels to feel content beneath their tyranny.

Though Campbell knew his science, he was always open to such dubious notions as Rhine's parapsychology; the "Dean drive," which claimed to sidestep Newton's laws of motion; and L. Ron

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Hubbard's Dianetics. He let Hubbard announce that in a featured article in *Analog*. Himself a convert and involved, he wrote letters urging me to come to the New Jersey headquarters to be audited and cleared. Treatment was to cost six hundred dollars. He claimed miraculous cures of nearly every human ill and scoffed at the analysis under Dr. Tidd that I had just concluded. I was unconvinced, but van Vogt quit his writing and spent some years as a Dianetics practitioner.

Campbell and Peg, his second wife, used to speak of their own mental research. I wondered if they were auditing each other, but I never knew what, if anything, Dianetics did for them. It did nothing for *Analog*. Though he stayed on as editor and kept a loyal readership, he was no longer the dynamic leader of the pack.

He bought a sequel to *The Seetee Ship*, but rejected *Dragon's Island*, a novel that has its own space in my heart for what the dictionaries admit is the first recorded use of the term "genetic engineering." Perhaps I went too far for him, with a space ship grown from an engineered seed. Fred Pohl, my agent by then, sold the novel to Simon & Schuster.

Two strong rivals to *Analog* appeared in 1950, Tony Boucher's *Magazine of Fantasy and Science Fiction* and Horace Gold's *Galaxy*. Boucher wanted style and literary value. Gold wanted darker and stranger visions. Still not quite at home in the brave new postwar world, I submitted nothing to either. I was at home one day in Portales, stalled on another novel I had sold but was never able to finish, when I got an astounding rescue.

The editor of the New York *Sunday News* called to ask me create a new comic strip. A most unlikely event. Somebody at the *News* later told me they received 25,000 submissions a year and bought none of them. The miracle happened because a *New York Times* book reviewer, with no generous intentions, had compared *Seetee Ship* to the space adventure comics.

As it happened, the *Sunday News* was looking for a space adventure strip. Once selling nearly three million copies a week, it had begun to lose sales as readers turned to TV. Somebody thought a new strip might help hold circulation. I went to New York and worked with the editors and the artist to design *Beyond Mars*. Based on my seetee stories, it was drawn by Lee Elias, who had learned his art from Milt Caniff. The *News* let me call Chester Gould for advice on story structure. The strip ran for three years on the back page of the comic wraparound, opposite *Dick Tracy* on the front, and paid me more than I had ever earned.

A great adventure. I had never read comics or the tabloids. In New York three times a year to work out new episodes, I enjoyed learning a new craft and gained a vast respect for the *News* veterans I got to know. I saw old friends, met exciting new people, and dreamed of a new career, until the editors found that Mars was no answer to TV. They killed the strip. I returned to college, earned my degrees, and enjoyed nearly twenty years as a professor of English here at my hometown university.

I spent a long time away from the typewriter, though collaborations with Jim Gunn and Fred Pohl helped keep me alive in the field. Since I retired from full-time teaching in 1977, I've called myself a full-time writer once more, though I still enjoy meeting occasional classes. Ben Bova, who revived *Analog* after Campbell's death, bought most of the stories that made up my novel, *Brother to Demons, Brother to Gods*. Since Stanley Schmidt, who followed him, bought a long section of my novel *The Humanoid Touch*, I have sold fiction to every editor of *Analog*, a record unlikely to be matched. Looking back across the years, I recall great stories, great friends, and a great life. I hope *Analog* lives forever. ■

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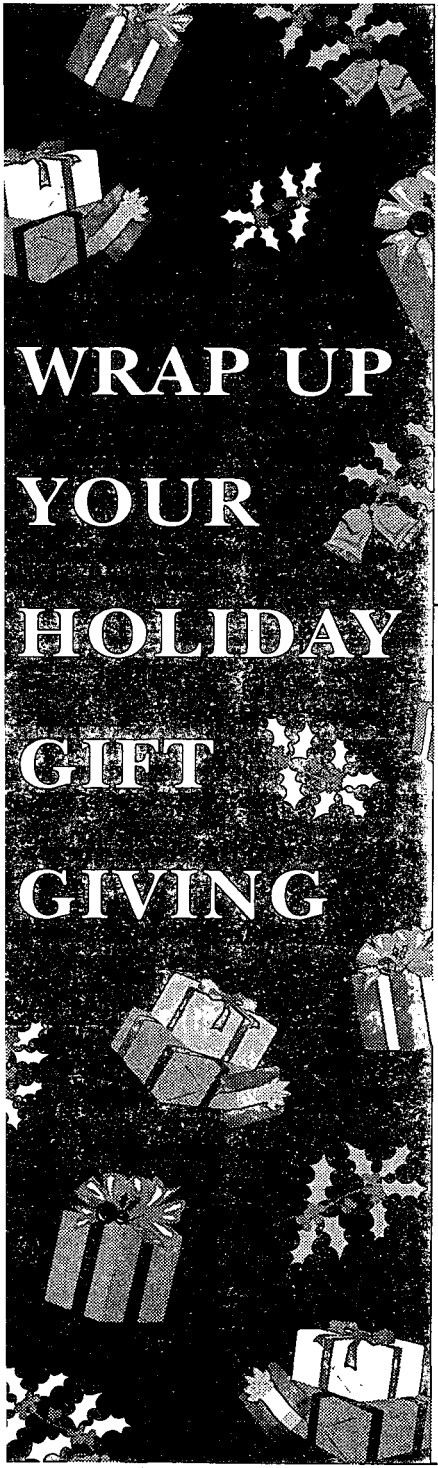

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Brian C. Coad

THE COST OF HAVING A KID

New choices make life much more complicated—but some things stay the same.

Sam Jordan had a hard time keeping up with the telethrips he monitored, even without interruptions. When a priority message flashed onto his screen, "Faeces," he said under his breath.

The message read:

ATTENTION INTANGIBLES INC. ACCOUNT # 632948. WE WISH TO REMIND YOU, IN THE NICEST POSSIBLE WAY, THAT YOUR CURRENT PROGRESS PAYMENTS ARE DELINQUENT. FAILURE TO KEEP CURRENT MAY RESULT IN THE LOSS OF YOUR CHILD.

Sam, of course, was account # 632948.

He deleted the message, muttered "Faeces" again, and went back to work. Work now involved pulling out of memory telethrip data that was automatically stored during the Intangibles interrupt. He rushed to catch up with real time, almost overlooked, in the stored data, a microcrack in one of the blades of the engine he was inspecting.

Luckily he caught the flaw, confirmed and logged it.

Then he was back in real time, concentrating as hard as he could. That was none too easy to do. Everybody's on my ass! The thought kept floating up in his head.

Sam was right. Everybody was out to give him trouble. Intangibles was typical. So was his boss, if he missed another flaw. He had already been warned twice. A third time, and it was all over.

Basically, Sam was a nice guy—a not overly ambitious techie, who only wanted to love his wife, father a daughter, and do his job well enough to be able to support them both.

And he always gave his employer his best shot.

Besides Intangibles and his boss, who else was on his ass?

He counted them up, paying less attention to the telethrips than he should.

Number one—no denying it—was Veronica, his beloved wife.

Veronica wanted their son, Tommy.

Sam had set his heart on their daughter, Helen.

Much as I love Veronica, thought Sam, she's a stubborn bitch!

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Not one inch would Veronica give. Day and night she was on him to accept Tommy instead of Helen.

Yeah, thought Sam, I can be stubborn too. It's me that pays the bills.

Number two on Sam's list was his mother. She was rich. She truly wanted a grandchild. If only she'd come through with a spot of cash, he thought, he could take care of everything—keep current with Intangibles—could father both Helen and Tommy—have no more arguments with his wife.

But the old dragon wouldn't do anything for him. Said, if they wanted kids, they ought to produce them the cheap old-fashioned way, same way she had produced Sam.

A fat chance Sam had of getting Veronica to go his mother's way. Not wholly modern Veronica. Veronica herself (she was a lot younger than Sam) was an Intangibles product. She would never dream of having a kid whose future was under the control of pure chance.

To hell with both women, thought Sam.

He caught another flaw he nearly missed. That sent a shiver up his spine. A third flaw missed—no job! No job, no money, no Helen, no Tommy, and probably no Veronica. Almost for sure, she would divorce him if he got himself fired.

Luckily he'd been lucky again.

Last and worst of all on Sam's list, and forever lurking in the background, was the freckle-faced boy from Intangibles, his account manager. Following Intangibles policy forbidding fraternization, that one, a mere child fresh out of business school, had no name but his official title, Intern Three Seven.

Sam wished to hell the boy had a name. He could curse him better if he did.

Three Seven was Sam's most frequent interrupter. He was probably behind that priority message a few minutes ago.

Money, money, money, thought Sam.

He half-believed the Three Seven kid had rigged his account and overcharged him. Unfortunately, what with holding down two jobs to keep up with the payments, he never had time to investigate.

Veronica would have time. She was a nurse, worked swing shift, had all day. But all she ever did with her days was play cyber games with her pretty Tommy, and not one moment to spare for anything else.

Veronica could help with the payments. But no! She said bills were a husband's responsibility. She had to save to give Tommy a good time when he was actualized.

The Three Seven boy always backed Veronica, anything she said. He kept urging Sam, if they couldn't afford to have both kids—which they couldn't—to forget Helen and settle for Tommy. Because of the delay, said Three Seven, costs were mounting. So were the billings. Settle for Tommy, you could save real money, said Three Seven.

I never will, though thought Sam.

How come that Three Seven boy looks a lot like Veronica's Tommy?

And how come the boy had not logged on to deliver the Intangibles message in person? He usually did.

Three Seven had not delivered the Intangibles message in person because, taking feed from the Jordan setup, he was in his cubicle watching Mrs. Jordan play hide-and-seek with virtual Tommy.

Fresh from business school, Three Seven had wholly dedicated himself to success with the Jordan account, the first one entirely assigned to him.

Besides, he had a special fondness for Tommy. Because, in addition to his MBA, he had a degree in fetal engineering, and had handled the technical as well as the business side of the Jordan account. It was not quite so, of course, but he looked on Tommy as a construct of his.

Three Seven would not admit it—Intangibles employees should never devel-

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op feelings for their clients—but he was also attracted to Tommy's future mother, Veronica. He admired her intellect, which led her to choose Tommy, the best of all the kids he had constructed for the Jordans, first time through. Nor was he immune to the beauty of her raven-black hair or her brown doe-eyes.

Veronica was around Three Seven's age—at most a couple of years older. Often he wondered how she'd come to hook up with an old fart like Sam Jordan.

On his screen Three Seven watched virtual Veronica, in a wood, search for virtual Tommy. Tommy, presently a cute three-year-old, had tucked himself none too invisibly behind a beech tree. Virtual Veronica circled the Tommy tree, crunched virtual leaves underfoot, and peered here, there and everywhere, except behind the Tommy tree.

Tommy giggled aloud.

Veronica went the wrong way, then, with a sudden twist, pounced and caught Tommy from behind. Her son's little snub-nosed face lit up as she grabbed him. She tossed him high in the air, caught him, squeezed. They giggled together.

So moved by this scene was Three Seven that he decided to project his cyberself into it, and join the fun.

He projected his cyberself.

Unfortunately, trouble arrived before he had a chance to join in, in the form of virtual Sam Jordan, whose own cyberself loomed into view. Sam clomped up to Three Seven. He yelled: "I'll thank you to keep away from my wife!"

Immediately Three Seven withdrew to reality.

Perhaps with virtual ears, perhaps with real ones, he heard Sam tell Veronica to quit wasting time on Tommy.

Virtual Sam told Veronica to get Tommy wiped.

Three Seven, now all in reality, thought virtual Sam was about to tear virtual Tommy out of virtual Veronica's arms. He came within a kilobyte of projecting his cyberself back again, to protect her and the child.

Luckily, a priority message blanked his screen:

INTERN THREE SEVEN!
COME BY MY OFFICE
WHEN YOU CAN TEAR YOURSELF AWAY
FROM WHAT YOU ARE DOING!!

The message was unsigned, but Three Seven knew it must be from his supervisor, Highonhog Eight. "WHEN YOU CAN TEAR YOURSELF AWAY," he knew, meant "COME AT ONCE!"

He cut the Jordan feed and hurried from his cubicle.

It was a privilege for Three Seven to be supervised by Highonhog Eight, several levels up the Intangibles ladder from any new-hire intern. The great man terrified Three Seven, who had suffered a serious stress interview overseen by him before being hired. But he knew he must get along with Highonhog if his career was to blossom and bear the fruit he desired and deserved. So he worked hard at it.

Highonhog's interruption pleased him, too. As he passed along the corridors that led to the great man's office, he reflected he might easily have perpetrated a rash and career-damaging intervention, had he not been drawn away from the world of the virtual Jordans.

Highonhog's office was huge and windowless with a carpet so thick, some people's feet actually stuck to it. When he was not overseeing stress interviews, the great man dominated the office from behind his desk, which was raised on a high platform, and was so lit (by experts) that his jawline stood out in the fashion invented by the dictator Benito Mussolini, and from his time on, was copied whenever convenient by all persons in high office.

As well as a firm jawline, Highonhog possessed a drooping Mandarin moustache (a mark of multiculturalism), and

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wore a stiff brush of pseudohair on his head. Despite the reports of certain supplicants who came before him, his piercing eyes were grey, not dragon-red.

Three Seven advanced in the posture (as he interpreted it) of a supplicant. Not for nothing had he endured three years of business school. He advanced towards Highonhog's desk, calling on his education to conceal his true feelings—mainly fear, at the moment. Luckily his shoes were leather-soled, slippery on smooth ground, with no tendency to stick to the carpet.

Highonhog's face, he noted when he came close, was flushed. Anger? Or high blood pressure? But his supervisor's moustache bracketed a smile. It did not look as if this was to be another stress interview.

There was a chair on Three Seven's side of Highonhog's desk, with a seat high enough off the ground for its occupant to be on eye-level with the great man.

Highonhog gestured for Three Seven to become that occupant.

Three Seven climbed up and occupied the chair.

Highonhog leaned back in his chair. The clever lighting made him seem less formidable, almost benevolent. He surveyed Three Seven with half-closed eyes which, if they were not dragonish, were at least piggish.

Eventually Highonhog spoke. "I've been watching you in action, Three Seven. You are substantially more expensive than our average hires, but I think we did well to hire you. You use your Fair Trade and Practices card to the limit the law allows. You continually monitor the activities of the people involved in your account."

"I haven't done anything illegal, have I? Invasion of privacy, anything like that?"

"Certainly not. Privacy is dead. In modern times, transparency is the order of the day for everybody, especially our clients, in whom we have an undeniable financial interest. By law, they are, to us, in the public domain the moment they enter cyberspace, as the Supreme Court has ruled a dozen times over. Monitor away to your heart's content, Three Seven. But why, pray tell me, do you principally follow the female protagonist of your account? Have you forgotten that it is the male protagonist who pays the bills?"

"I haven't forgotten," said Three Seven, "but I feel it is wise to keep in touch with the lady's feelings. An account manager never knows when he can up his bottom line a bit by manipulating his client's feelings."

"True. You make a good point, Three Seven. I called you in primarily, however, to discuss your own feelings. You know how it is with feelings. Let a hint of them float through your metabolism when you are bringing a business deal to closure, and you are quite liable to find yourself, suddenly, mired in a morass of nasty neurochemistry fountaining up inside you, ruining your objectivity. You're not permitting the female component of your account to stimulate such secretions within yourself, are you?"

"Certainly not."

"Good. Keep always in mind Section Five, Paragraph Eight Seven One, of the Corporate Manual: THE CULTIVATION OF EMOTIONAL ATTACHMENTS TO CLIENTS DURING BUSINESS HOURS OR OUTSIDE BUSINESS HOURS IS CAUSE FOR INSTANT DISMISSAL. I expect many years of good work from you, Three Seven. I should feel personally hurt, over and beyond the cost of the separation bonus you managed to have written into your contract, should I be obliged to dispense with your services."

"I'll do my best to avoid hurting you."

"Yet I do sense you are vulnerable to misplaced feelings. Your Ethics Professor wrote"—Highonhog produced a printout from a drawer in his desk—"'This student resists internalization of the basic business axiom, that the great-

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est good for the greatest number results when employees submerge personal considerations and exist solely to maximize an employer's bottom line.' Have you done some internalizing since you joined us?"

"That Ethics Professor never liked me."

Three Seven did not answer the question. He did squirm a bit, on his high chair.

"Well, we hired you for better or worse. You are glad, I trust?"

"I am! I am!"

"Good. Now for a spot of nitty gritty. How come you've let the male item of your account fall behind with his progress payments?"

"Sam Jordan is not flush with cash. He's also resistant to the choice of kid his wife, Veronica, prefers. He would prefer Helen over her Tommy. While they argue, we have to keep all their prospective offspring on hold, so our costs keep going up, and so do our charges. But I do expect the rising expense, eventually, to break down his stubborness. If it does not take too long, his assets suffice to take care of his bills—perhaps with a little time-extension."

"You bring your clients' names into our conversation. That is bad. Unbusinesslike. What additional steps can you take to ensure your client becomes current?"

"I thought of offering him a rebate if he firms up on Tommy—"

"A rebate, Three Seven? Do you realize how much you cost Intangibles? How narrow our profit margin is? A rebate? That really is a terrible idea. Have you worked diligently on your client? Is he quite clear about his commitment? Have you reminded him that a breach of contract with Intangibles could cost him everything he has, his wife included? Have you put a little fear into him, Three Seven?"

"I don't like to press too hard. If he loses everything—and you are right about losing his wife—it won't do much for us."

"True. You appear to have internalized our Intangibles motto, 'WITH EMPATHY TOWARDS NONE, TAKE AS MUCH CASH AS YOU CAN FROM ALL.' Has your client no other resources than his employment to draw on?"

"His mother is rich—"

"Then persuade him to borrow from her. Is he her only child?"

"Yes."

"If you deem it necessary, have him murder her to receive his inheritance early. But do it subtly. We want no lawsuits suggesting Intangibles is an accessory before the fact. Whatever you decide, I want action. Press your client hard. Swear at him, if you feel it appropriate. Frighten him. I want cash in hand today, Three Seven, cash in hand. Today!"

Back in his own cubicle, Three Seven felt he had handled Highonhog quite well. He knew his next move must be to priority himself once more onto Sam Jordan's screen. Before doing so, he decided to peek in on Veronica and Tommy, partly to see that they had come to no harm, partly because, assuming they had not, it would be more pleasant than talking to Sam.

Tommy was nowhere to be seen, but Veronica appeared unharmed. She had projected herself into her own living room. Her cybersister, Sally, was with her.

Three Seven knew Veronica had a cybersis. Several times he had caught the two of them together. Apparently their parents had contracted with Intangibles for twin girls, but their money had run short, they could only afford to have Veronica actualized, and had to leave Sally virtual. In cyberspace, Veronica and Sally were as close as real sisters. He learned a lot, particularly about Sam, when he monitored them.

Sally was talking about Sam right then. "I feel for you, Sis," she said, "Sam forev-

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er bustin' in when he's not wanted."

"Me and Tommy were having such a fun time," said Veronica, "and that nice young fellow from Intangibles come to play with us, too, when there he was in the midst of us, like a raging bull. I tell you, I logged out of the program at the speed of light! I only hope I didn't lose no data."

"Lucky you, though," said Sally. "You at least got a realtime, fleshy, warmhearted husband. Sam's not like mine, no more than electronic gunk in a silicon simulacrum, that only exists when you remember to switch me on."

"Lucky, you call me! You don't know half of it, Sal. Sam's fleshy enough, but warmhearted he is not! He will not see sense about Tommy, and you know what? When he gets absorbed in that job of his, he don't touch me for weeks!"

"Is that good or bad? Anyway, a girl should be helpful, and do whatever her husband wants."

"Let him have his Helen, you mean? Give up on my Tommy? You know I can't do that. Sam's mixed up in his head. He's into heroines. You know what kind of little bitch his Helen is? We've not projected her past ten years old, but she's a regular hoyden already. Cold. Hard. Like to grow up to be maybe a general, maybe a top bureaucrat. Whereas my Tommy's all virtue and loveliness, full of human feelings, irresistible to girls—"

"Sure, Sis. You've shown me. I could go for him myself. Why not let him stay virtual and turn him over to me?"

"You go have your own kids."

"I never could produce one nice as Tommy, not with my husband. You really should let me have Tommy, pick some other kid you and Sam can agree on. How many you got to choose from, anyway?"

"Not that many. A thousand? Fifteen hundred? We didn't have the money to get any more projected. Sam and I checked them all out. Only one I really like is Tommy. Only one Sam really likes is Helen."

"So have both of them."

"Can't do that."

"Why not?"

"Same reason I'm real and you're my cybersis. Not enough cash. Besides, I wouldn't want that Helen even if we did have the money."

"Then start over. Have Intangibles project another thousand for you to choose from."

"You don't know what you're suggesting, cybersis! You never had to get a clutch of ova scraped out of your reproductive organs. I don't want to go through that again. It's as bad as giving birth."

"Sam must love you. He had to go through the same procedure."

"Same procedure, nothin'! Men? All they do is provide sperm, which is no trouble at all for them. A girl lifts the hem of her skirt half an inch, and they produce a billion."

"Sorry I'm so ignorant, dear Veronica. Of course, if I'd been actualized, like you, I wouldn't be. Educate me. How does it work? What do them Intangibles people actually do?"

"Come on, Sal. I've told you a hundred times."

"I'm only virtual, you know. I can't remember. Maybe somebody wiped me."

"If you weren't my Sis that I love, I wouldn't bother to go over it again. Seeing it's you—just once more—"

"I'm all cyberears."

"Intangibles medical staff take a clutch of eggs out of the wife. They genotype them. They take as many of the husband's sperm as the couple can afford—a hundred, in our case—and genotype them. Then they combine sperm and eggs, permutation-wise—computer simulation, of course—producing hundreds of virtual kids. They collect every scrap of data they can get their hands on about we potential parents—our social status, relatives, and stuff—and about the culture and nation,

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and what's going to happen next in the world. There's enormous data banks available. From it all, they can project a life-script for each child, which we parents get to study and pick out the one we feel will be most compatible. Then, when we've selected the right one, its genome is placed in an egg, implanted in a surrogate, and finally you have your baby, all actualized. In our case, the baby will be Tommy."

"It's a pretty time-consuming process, isn't it?"

"What's time to you in cyberspace, Sal? Anyway, can you think of a better use for time? Our kids are our future."

"You and Sam went through all the thousand, or fifteen hundred, or whatever it was?"

"We sure did. Spent at least half an hour per kid. And no question about it, the best of the lot was my Tommy. I won't let Sam cheat me of him. You know what, cybersis? If I lose Tommy, I swear I'll go virtual and come live with you!"

Reminded that time marched steadily on, Three Seven felt he must leave Veronica and Sally, and get down to business. It was good to know Sam's intrusion had done Veronica no damage. He disliked her thought of retiring into virtuality, but he did not believe she would act upon it. She certainly would not, if he could arrange for Tommy to be actualized.

Thinking that thought, he used his card and prioritized onto Sam.

"Faeces," Sam mouthed, when his screen clouded over.

Sam's job was to inspect jet engines at their ten-thousand-hour checkup. He had sixty thousand telethrips crawling, micron by micron, through the blades and vanes of engine #24675 MND, searching for microcracks and flaws. Sam had to see they missed nothing significant, and double check (and report) anything they found. It was a responsible job. A missed flaw could result in a defective engine returning to service. Then, sooner or later, an aircraft full of people might fall out of the sky.

The job demanded Sam's utmost concentration.

Now that damn freckle-face from Intangibles was back on his screen chasing money again.

If I get fired, Sam thought, with a trace of satisfaction, Intangibles never will get their bills paid.

He controlled himself well enough to address the freckle-face. "What now? Make it fast, if you would."

Exactly at that moment the roar of an engine run-up test in another part of the plant blasted Sam's cubicle. The cubicle was supposed to be acoustically isolated, but engine tests always hit it like an earthquake.

Freckle-face said something Sam did not catch.

"Get back to me later," said Sam, his lips vibrating with the noise.

"Sorry, sir, I can't do that." His ears just managed to hear. "Intangibles has a financial interest, therefore I am within my rights to insist upon priority. Could you please turn down that noise?"

The noise chattered Sam's teeth as he gritted them. He thought of his unmonitored telethrips spreading wild. But he knew he had no choice but to listen to the Three Seven boy from Intangibles.

Suddenly the engine run-up ended.

"Thanks for cutting the noise, Sam," said the boy, who knew nothing about nothing. "You're so far behind with your progress payments, it's come time for us to get down to the nitty-gritty. Why don't you just settle on the little boy Veronica wants? If you settle on Tommy, we'll know where we are. I can give you a good deal, reschedule your payments. You'll pay a bit less each month, for a bit longer, and you'll be in the clear."

"We're not having Tommy," said Sam. "That's final."

"Your credit rating is dropping, you know, as your delinquency increases. You can't let this go on much longer."

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"You're squeezing just about every penny I have out of me already. Now you're interrupting my work. I may pass an engine that fails and kills a lot of people. I may get fired."

"Intangibles business comes first," said Three Seven. "That's how the laws are written. What if you do kill a lot of people? Shit happens. My Company's bottom line is what matters. If you must carry on this feud with your wife, can't you borrow cash from your mother?"

"Hell, no. I'm sure, in this age of transparency, you already know that."

"We did conclude she's out of touch with the times. You sure you can't influence her? You are her sole heir?"

"Yes."

"So if something should happen to her . . . But let's get back to practicalities. Chief thing is, you're not making up your mind, which pushes our costs up, so we have to charge more, and you can barely make your payments. The way I see it, Sam, you could either, one, go along with Veronica, confirm Tommy, and let me reschedule your payments; or, two, persuade Veronica to go along with you, confirm Helen, and same thing; or, three, go for both Helen and Tommy, which would be expensive, but could be within reach after I've done the rescheduling."

"Those are all the choices I've got?" asked Sam dryly.

"Well, there is four, start over with new ova, fresh sperm, and a new batch of virtual kids, hoping there'll be one you and your wife can agree on. But I think that is out of your price range."

"I could cancel the whole deal. Veronica and I could go childless to our graves."

"You'd still owe Intangibles for services rendered already, plus the cost of breaking your contract. I'd say you would be broke for at least a dozen more years. It would be cheaper to settle for Tommy. If you like, I can show you the figures."

"I would not like," said Sam.

"OK. Figures *are* a bit depressing. Settling for Tommy is definitely the cheapest way for you to go."

"The hell with Tommy."

"Best thing about going with that kid is, you get to keep your wife. Veronica will leave you for sure, if she can't have Tommy. Why don't you get with her, have a heart-to-heart talk, see if you can't work things out? Then get back to me. OK?"

"OK." Anything to get rid of you, freckleface, thought Sam.

"And remember," said Three Seven, "even if you don't think she'll help, your ace in the hole is your mother."

"Goodbye," said Sam.

"I watched you, Three Seven," said Highonhog Eight. "You did fairly well. It's quite a good idea of yours to extend your client's payments over a longer period. We can add interest to the bottom line. Now you should probably work on the female. I shall not be entirely satisfied with you until you bring the business to closure."

Three Seven took Highonhog's advice to heart, but, due to Veronica's evening shift at a local hospital, where she was not interruptible, he had to wait until the next day to go to work on her.

Sam and Veronica, of course, met when she came home from work. Sam might or might not have had his heart-to-heart talk with her. Despite transparency law, Three Seven could not know anything about conversations that were not online.

About eleven next morning, Three Seven decided Veronica had probably had enough sleep. He called her at home. She was awake. He asked permission to visit her in person.

Veronica said she would be delighted to see him. Two o'clock, she said, would be a very good time.

Three Seven arrived at the Jordan house at five minutes of two.

Veronica welcomed him.

She had been weeping.

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She let him hug her.

They went into her living room. The Jordans' giant wall screen was activated. They sat on overstuffed chairs, and watched virtual Tommy, aged six, riding through a forest on a fawn.

Tommy wore a green Robin Hood outfit which, if not buckskin, might have been Bambiskin. There was a bow in his hands, an arrow notched, a quiver of arrows on his back. He stalked a butterfly.

"Such a beautiful child," said Three Seven.

"Sam's been giving me a terrible time."

"I know. He should take time to see what Tommy is really like!"

"He will," said Veronica. "I gave him an ultimatum. He must settle for Tommy, or lose me."

Three Seven stood up, went over to her, kissed her forehead. "I cannot tell you how much I admire your decisiveness," he said.

He returned to his own chair.

Tommy loosed an arrow at the butterfly.

Three Seven did not see if the arrow struck its mark. Suddenly, while it was still in flight, the giant screen went dark. "POLICE OVERRIDE! POLICE OVERRIDE!" The letters glowed ruby-red, while a gruff computer voice uttered the words from the speakers.

Sam had, in fact, spent half the night confronting Veronica. It had only been half the night. They both needed *some* sleep. But there was a further confrontation in the morning, while he prepared to go to work. He then stomped, breakfastless, out of their house.

Under no circumstances, he told his car as he got it started, would he accept Tommy. Let his bitch of wife do her worst. Let her divorce him, if that was what she wanted.

He drove to a coffee shop.

He stopped for coffee, and to calm down before going to his job.

Coffee stimulated reflection. A bitch Veronica may be, he thought, but I still love her. No doubt about that.

He remembered his first sight of Veronica. She was a high school senior, competing in the shot-put at an interscholastic athletics meet. His mother had dragged him to the meet. His mother was full of good deeds. She often sponsored such events.

In recall mode, Sam admitted to himself he had been in love with Veronica from his first moment of seeing her, and forever after. He was hopeless about it, though, at first. He was far too old for her.

Then his mother had gone to work. She was an insightful old dragon, and saw what had happened. She wanted Sam settled, wanted that grandchild, so she went ahead and organized everything. Even she took five years to get it done, but Sam and Veronica were finally married.

Then, thought Sam, we enjoyed a couple of years of sheer rapture. We really did.

Veronica must love me, thought Sam, if only for those two years. She had enjoyed them as much as he had.

Heck, she must have loved him from the first. Why else would she have married an old engineer, already bald on top, with not much in the way of prospects? His mother? She was powerful and had a bit to do with it, but she was not that powerful.

Now this wretched Tommy had come between them.

His mother had a bit to do with that, too. She had a fortune in the bank. If only she would spring a few dollars of it to help them find her a grandchild he and Veronica could agree on—

But she would not—not a penny!

No way he could persuade Veronica to have a child the way his mother wanted, the old-fashioned, low-cost, natural way. Nothing but the hi-tech best for Veronica! She and his mother never really got along, and there was not much

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peace for him until he signed up with Intangibles.

When they had their child, Veronica said, his mother would soon come round.

He knew she would not. They had played all the kiddytapes for her. She hated all the hi-tech kids, including, Sam recalled with the nearest approach to pleasure he experienced that morning, Tommy.

She hated Helen, too.

And he was alone, with the bills.

If Veronica had not kept throwing Tommy in his mother's face, faxing her pictures and such, he might have brought her around. She had been good to him once, when he was small.

On his third cup of coffee, it suddenly hit Sam that Veronica could be taking revenge on his mother for bringing her and him together! Maybe Veronica was simply tired of him.

Could he let her go? Drop the whole kiddy thing, and let her go?

Could he live without her?

Hell, no, thought Sam.

Mother's the real villain, he decided. If she would have been sensible, helped with the bills, Veronica would not be all fixated on Tommy. We could have picked some other kid that fit with all of us.

One more coffee, thought Sam, and then off to work.

He had his cup refilled, poured in an excessive amount of sugar, added cream, stirred, and saw his mother's face in the swirling liquid.

You know what, mother?—he addressed the face—I'm coming to see you. Now!

Later, at his trial for the murder of his mother, his lawyer was to use the famous excess sugar defense on the jury, but with no success.

"Bludgeoned to death, she was," said the police officer's image superimposed on Robin Hood Tommy on the Jordan's giant screen. "I'm sorry to have to tell you this, ma'am. Your husband's car was on the tape that keeps tabs on the lady's apartment house. We're pretty efficient, tracked him down in less than half an hour. He was in a bar, drinking. Murder suspects most always go to a bar and drink after they've committed their crime. We arrested him. He has a lawyer, so there's nothing for you to do."

"I'm glad," said Veronica.

Three Seven wondered if she meant she was glad there was nothing for her to do, or was glad Sam had been arrested.

"You say something, ma'am?" asked the officer. "No? Let the record show the lady shook her head. That's all for now, then, ma'am. Except I have to warn you not to go anywhere. We may want to investigate you as an accessory before the fact."

The officer disappeared. Tommy came back. Nothing suggested he had hit his target butterfly. On his fawn, he stalked another creature, this time a caterpillar.

Veronica watched Tommy for a moment, but even he could not hold her attention. Soon, she exited the program, ordered music.

"What," she asked Three Seven, "did the policeman mean, accessory before the fact?"

"I wouldn't worry about it," said Three Seven.

"But I am worried," said Veronica.

Three Seven was obliged to go over to her chair again, take her in his arms, and comfort her.

He comforted her until his beeper went off.

"Highonhog Eight calling Three Seven," said the beeper when he activated it. "Come to my office at once, Three Seven."

"I'm afraid I have to go," Three Seven told Veronica.

"Your client has been arrested for the murder of his mother," said Highonhog Eight. "You've made a right mess of things, Intern Three Seven."

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"You suggested I tell him to murder her," said Three Seven.

"I did nothing of the sort. In any event, that is not the point, is it? If he did the murder—and all the evidence says he did—he won't inherit, and he will spend a long time in jail, whereupon the value of the Jordan account to our bottom line falls away to precisely zero. Intangibles will be out a small fortune, a direct consequence of your incompetence."

"My incompetence? I didn't tell Sam to murder his mother."

"An account manager's liability for acts of his client is without limit. You should have anticipated Jordan's intentions, and stopped him. Quite possibly the police will be after you, too, for your part in this sorry affair. Attempted extortion from a client in order to curry favor with your management. That sort of thing. Well, Three Seven, I can tell you here and now, Intangibles can neither afford, nor deserves, to be dragged into a criminal morass. Don't interrupt. Nothing you say can save you. I'm afraid we must recognize we made a mistake, and dispense with your services."

"I'm fired?"

"Colloquially speaking, yes! I am deeply hurt to have to do this to you. My opinion of you earlier was that you were destined for greatness. But I have no choice—"

"May I not at least have a chance to wind up the account?"

"I'm sorry, Three Seven."

"Do I get the separation bonus written into my contract?"

"I fear so. Trust you to think of it, Three Seven, self-centered as you are. However, the potential legal harm to Intangibles if we argue about it far outweighs your few bonus dollars."

"I'll be on my way, then," said Three Seven.

The cost of having a kid is high nowadays. Happily, in the Jordan case, everything eventually sorted itself out satisfactorily for everybody except, perhaps, for Highonhog Eight.

Sam Jordan was found guilty. He was sentenced to life in prison.

In jail, he was, from the first, happier than when he had to monitor telethrips day after day. For a time he missed Veronica, naturally, but with the help of psychiatrists (of whom there are plenty in modern jails) he soon saw he was more addicted to her than in love with her. They showed him how to recover from his addiction, which he did, and was proud of it.

Veronica, as a result of her "I'm glad" on the police officer's tape, was quizzed long and hard to see if she really was an accessory to her husband's crime. Luckily, she inherited Sam's mother's money, which he could not, and it provided her with lawyers good enough to get her exonerated.

Intern Three Seven's separation bonus from Intangibles enabled him to match Veronica's fortune. Had he not received the bonus, he would probably have felt obliged to break off his connection with her. As it was, he felt he was her equal. They saw a lot of one another. After her divorce from Sam, they were married.

He brought a very special bonus to their marriage.

While at Intangibles, Three Seven had collected a personal copy of the Tommy program, complete with Tommy's genome. He was able to use it, with the assistance of a pirate competitor of Intangibles, to actualize Tommy. Tommy, Veronica, her cybersis Sally, and he now live happily together. He and Veronica frequently talk of using the pirate corporation to obtain a brother for Tommy.

Three Seven also talks of resuming his managerial career. Recently, he updated his resumé. Getting a new job will be a lot easier for him this time. He now has some real world business experience under his belt, to back up his MBA. ■

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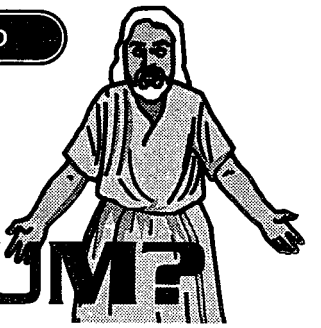
Probability Zero

Michael A. Burstein

WHOSE MILLENNIUM?



It was Sunday night, and getting very close to dusk. I had pulled desk duty, which basically meant sending out the robots whenever a crime was reported. Desk duty was boring, but it was a lot better than being a followup. Especially given the level of violent crime in the megalopolis of Chicago—or anywhere in the world, for that matter.

I was mostly intent on the many screens in front of me, when out of the corner of my eye I thought I saw a bright flash of light. I looked out the blaster-proof windows on the heavy metal doors, but saw nothing unusual in the dark, moonless evening, other than the snow.

That's when the old man walked in. He wore a robe and sandals, like a character in a play about ancient times. He looked around, disbelieving, at the screens which monitored the whole city.

"Can I help you?" I asked.

He peered at me and then his eyes focused on the desk. "Your name," he said, staring at my nameplate. "You are Sergeant Cohen?"

"That's right."

"But—it is *yom tov*. Shouldn't you be in—in *shul?*"

"*Shul?* What's *shul?*"

He shook his head, like he was trying to clear something out of it, and then asked another question. "Where do the Jews go on Friday night?"

For a moment I didn't understand. Then I recalled something out of history class. "Jews? Are you talking about religion?"

He nodded. "Yes."

A sound like a blaster shot came from outside, so I paused to order one of the robots out to investigate. "Religion. Now that's a funny one."

"Funny?"

I gave him a derisive look. "There is no more religion anymore, old man. People came to their senses, oh, about two hundred years ago."

He looked worried. "Tell me, what is the date?"

"The date? It's September 29, 2239."

He glared at me, and for a moment I felt an odd sort of fear. "No. It is the month of Tishrei. The first of Tishrei, in the year 6000."

I boggled. "The year six thousand? You have to be joking."

His voice took on a serious tone. "I do not joke. Tonight begins the first day of the new millennium. The *Rosh Mamlechet Elef Shanim*. The start of my—the start of the thousand year reign."

I shook my head. "The start of a new millennium? No one would believe that."

He looked away, a sad expression on his face. "No," he said. "Not anymore." He sighed. "Once people asked what would happen if the Messiah came, and there was no one there to greet him. Now, I know."

"I don't understand."

He smiled at me, a smile that claimed to understand who I was. Then he spoke, one last time. "'Wherefore, when I came, was there no man? When I called, was there none to answer?' Isaiah, chapter fifty, verse two."

He pushed open the doors and walked back into the freezing early autumn snowfall.

I shrugged, and went back to work.

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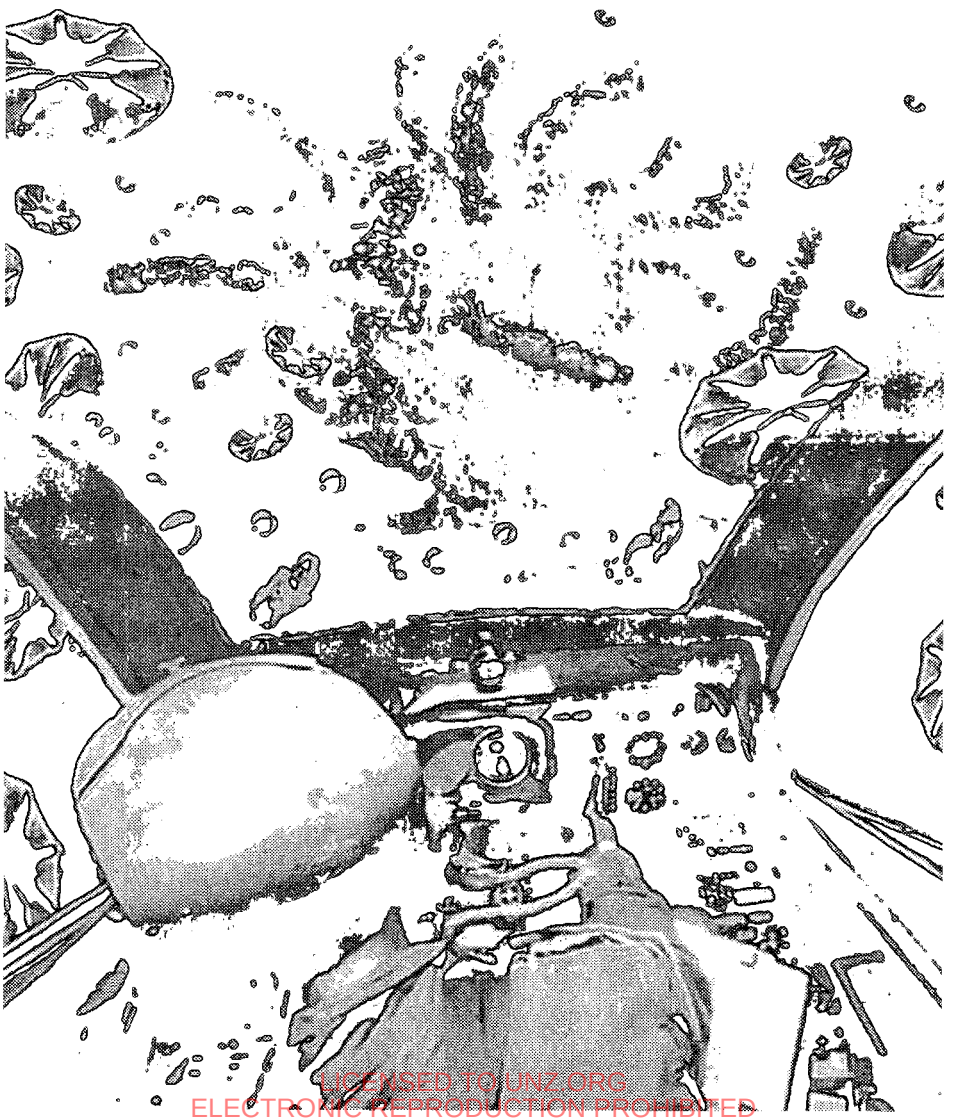
Pete D. Manison

TETHYS DEEP

Humans have often longed for "immortality" and may not have exhausted the ways to achieve it. . . .

Illustration by Broeck Steadman



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It senses their approach through the frozen shell that surrounds it in its womb. It knows who they are, but it is uncertain what to do. All is in readiness. The cycle is nearly complete and the timeless waiting at an end. It hesitates. They *are out there. They must not be harmed. It remembers that much. They must escape. But they cannot be put before its own survival. If that is threatened, then they must die.*

"I'm only going to say this one more time." Sonya's voice was as hard as the ice that surrounded them. "Surface this thing *now*."

Felicia smiled. It was her best defense, she had learned, though she suspected her sister was becoming immune to it. "Would you mind sitting back? You're obstructing my view."

Sonya didn't answer. Felicia concentrated. This was no time for bickering. Forward motion read five meters per second, and at that speed the sub was almost on top of small objects by the time she spotted them on radar. Her reactions had to be quick and true. She could feel sweat trickling down her face, even in the microgravity. And to make matters worse, there was the dead touch of Xin's still-warm body where it pressed against her leg within the cramped interior of the sub.

"Look out!"

Felicia spotted the bubble in time to avoid losing control, but the ice-sub shuddered as it hit the air pocket and then plunged beyond it. Felicia's fingers trembled at the controls. If the pocket had been larger . . . She eased the throttle back, just a little, to give the forward melter more time to do its job and to allow her another half-second's warning of obstacles.

"You're a biologist," Sonya said, "not a pilot. You're going to get us both killed." Her voice was level, but Felicia knew she was not alone in her fear.

"Look, we're almost halfway. It's just as easy to go the rest of the way down."

"But then we have to get back *up* again."

Felicia spared her sister a quick glance. "Only if . . ." She couldn't finish the thought. How *dare* she assume the worst! LOS didn't mean the base . . . didn't mean their father . . .

"Maybe the ice sheared the cable again," she managed.

"Yeah," Sonya said. "Maybe."

The sub bucked again. They were passing through a boundary layer where the ice had run molten when Tethys was younger and more geologically active. The headlights flashed off fault lines, transformed them into walls of green, red and blue. Felicia would have found it beautiful if not for the thought of what might have happened to her father, what it might mean for the biosphere they'd worked so hard to study and protect. If not for Sonya . . .

"I know what you're feeling," her sister said quietly. "I feel it too. But this isn't the way to help him."

Felicia didn't take her eyes off the monitor. "I've trained on the simulator," she said. "I can handle it."

Sonya shook her head. "Piloting an ice-sub is no video game. Too fast and you exceed the melt-zone and ram the ice. Too slow and you're caught in the refreezing wake—entombed forever. It took Xin three years to—"

"Xin's dead," she said.

"My point exactly."

Felicia ignored her. She thought of a day long ago on Earth, before the SciCorp grant, before their mother's decision. It had been a warm spring day, and the four of them had taken a hike through the woods. As usual, their father had stopped to identify every plant they encountered.

Felicia, only seven, was not to be outdone. "Look, Daddy!" she'd proudly exclaimed. The leaves were large and sharp-edged. And it was *her* discovery. "What is it?" she'd asked eagerly, thrusting a handful of leaves under his nose.

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He'd smiled. "Poison ivy, dear."

That night, the rash had taught her that her father never, *ever*, made a mistake..

"Watch it!"

Felicia jumped as Sonya's voice reverberated through the tiny cabin. She saw the shadow coming at them, dodged left just in time to avoid it.

"Rock zone," she said. "We must be nearly to the Core."

More dark shapes flashed by. Each time, Felicia eased the sub to one side or the other.

The alarm blared.

"Big one!" shouted Sonya. "Steer left!"

Felicia banked the sub hard. By the time she saw the smaller shadows, too tiny to be picked up on radar, it was too late to evade them.

"Hold on!"

The sub shook violently, and there came the terrible sound of rock grating against metal. Forward momentum slowed.

"Damn!"

"What is it?"

"We're losing the forward melter." Felicia was surprised at the calmness of her own voice. *Dammit, Xin! What a time to have a heart attack!*

The yellow bar on the panel before her began edging toward the red. Felicia caught a glimpse of her face in the curve of plastic that covered one of the gauges. Wavy brown hair, smudge of a nose, dimples—it was the face of a little girl, she thought, except for the eyes, brown and hard, showing more than her thirty years and the drive she'd inherited from her father.

Showing fear.

Who am I kidding? she asked herself. *I'm no pilot.*

Then the idea hit, and she forgot her doubts.

"I'm going to try something," she told Sonya.

It wasn't easy rotating the sub when the water ahead was already beginning to thicken with ice crystals. She brought the aft melter up to maximum temperature and threw the sub into reverse. As their speed increased, they began to outrun the refreezing water in their wake.

"Keep your eyes glued to that radar," Felicia said. "At this speed . . ." She fell silent. It was difficult enough piloting the sub without trying to talk at the same time. The aft monitor was just as good a guide as the forward, but with the controls reversed, she had to think carefully to avoid making a costly mistake. Sweat began to run down her face again, held against her skin by surface tension, stinging her in eyes. She suddenly realized she was gripping the controls with such force that her fingers had gone numb.

And then, with one final lurch, it was over.

"You did it," Sonya said.

Felicia looked up. The sub's lights stabbed out into infinity. She could see the curve of ice receding behind them. Ahead: the calm waters of the Core.

They are close now. A part of it stirs with urgent emotions, but the other part is older, wiser. It will wait. It will let them come to it. And when the time comes, it will decide their fate.

"Tethys Deep, this is ice-sub *Clarke*-7. Come in, please."

Silence—not even a trace of static so far beneath the moon's surface.

"Tethys Deep, are you receiving? We have entered the Core and are en route to you. Please respond."

Nothing.

"Tethys Deep—aw, I'm wasting my time."

Felicia looked up. "Keep trying," she said.

Sonya glared. "Since when are *you* giving the orders?"

"This isn't the time for sibling rivalry! For once in your life, will you just cooperate?" She brought the sub to water mode as she spoke. With the melter shut down and the nanodiamond sheath

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retracted, she was able to increase their speed.

"Tethys Deep, this is ice-sub *Clarke*-7. Do you read me?"

Felicia felt her heart pounding as she listened for a reply. She tried to distract herself by taking in the view beyond the sub's transparent canopy, where the water teemed with living creatures of every size and shape and color. The biosphere had changed since Felicia's last dive. Many creatures appeared more scarce than she remembered, while the slow-drifting, little-understood "footballs" were much more numerous. They moved in great clouds through the zero-gravity waters, limiting visibility when the sub passed through them.

"Dr. Waller—Dad—it's me, Sonya. Felicia's with me, too. We're heading your way. Please respond."

No answer.

Felicia steered the sub around a school of pink "jellyfish" and picked up the lights of the installation at once.

"They still have power," she observed. She had to force herself not to increase speed now that the base was in sight. Preservation of the biosphere remained their primary responsibility, and a racing ice-sub with its sharp-edged fins and maneuvering props could do unthinkable damage among the blind and defenseless organisms that seemed to fill every cubic meter of water.

It called for the gentle touch.

"Tethys Deep, I repeat: This is *Clarke*-7. We have you in sight and are on final approach. Are you receiving?"

A great wave of footballs eclipsed the base. The things were everywhere. Encased in an impenetrable hide, this particular organism had given up none of its secrets to even the most stubborn investigators. The sudden population explosion added to the mystery. Especially, thought Felicia, since footballs had never been observed in mating and no immature footballs had ever been found.

"Tethys Deep, come in, please. We are—"

Sonya broke off as the living wave dissipated and the base came back into view. At closer range, the damage was obvious. C-module had ruptured, the hull apparently crushed, and at once they spotted the cause of LOS. The phone cable drifted snakelike in the gentle current. It had been neatly snipped in two.

"My God," Felicia heard herself say. Blood pounded in her ears, and she couldn't shake the image of her father, his body bloated and his open eyes staring as he drifted among the schools of alien fish. That was how she would find him—she felt certain of it. And what would be left for her then?

"Two modules are still intact." Sonya was squinting into the water, her face scrunched up in concentration. "Maybe Dad and the others were in A or B module when it happened."

Felicia nodded, feeling numb, feeling that it wasn't so.

"You taking us in?" Sonya asked. "Or do we sit out here forever?" It was the nearest thing to encouragement Felicia would ever get from her sister. It was enough.

The docking came off without a hitch.

"Check the board," Felicia ordered. Then, realizing she needed Sonya's full cooperation, she added, "Please."

Her sister seemed not to notice. "I'm showing normal pressure in this module. We shouldn't need our suits."

"Good." Felicia accessed the base computer and initiated pressure equalization. In seconds, she had a green light.

"Ready?"

Sonya met her eyes, looked away. "Felicia . . ."

Felicia touched her sister's arm. "I know," she said. "Whatever we find, I'm ready."

Sonya seemed to relax. She moved to the hatch and began turning the manual fail-safe knobs. Felicia watched her sister's hands, concentrated on her fingers and the way they glided over the knobs,

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then snapped the handle down and out with precisely controlled force. The more she concentrated on these things, the more the image of her father faded from her mind.

Water droplets drifted in the airlock, indicating recent use. Two diving suits were missing. Felicia propelled herself across the compartment while Sonya closed the exterior hatch behind them. Only then would the safety systems allow access to the interior.

"Dad? Dr. Hernandez? Is anyone aboard?"

Metal clanged against metal somewhere in another compartment. Felicia and Sonya exchanged a glance, then Felicia moved to the intercom.

"This is Felicia Waller," she said, trying to keep emotion from her voice. "Sonya and I have entered through Airlock 2. Is there anyone aboard?"

There was no answer—only silence.

"We'll have to check one compartment at a time," said Sonya.

"Great."

B Module held no sign of life, but they found trouble in the control room.

"Look at this! The reactor program's gone crazy!"

Felicia looked over Sonya's shoulder, but the tone of her sister's voice told her more than the readings did.

"This thing's on overload! Someone deliberately shut down the cooling system, bypassed all the safeties, and cranked it up to max output. We have hours, maybe. Then . . ."

"You're the computer expert. Can you reverse it?"

Sonya tapped at the keyboard, then pulled her hands away as if the keys had been hot to the touch. "No time," she said. "Whoever did this really knew what they—"

Something moved in the corridor. Felicia whirled, forgetting the weightlessness, and it was a moment before she could halt her spin. In that moment, she caught sight of a face in the hatchway—a white, bloodless face with black, tortured eyes. Then it was gone, and Sonya was headed out the door.

It has waited millions of years by the time-scale recently learned from the other part. Memory stretches back, unbroken, to the time of light and heat, to the long darkness before arrival in this place. Conditions are perfect here. Tidal forces keep the core molten, allowing it to thrive. Release need not come for eons. It has learned patience. It would be content to wait forever, almost, were it not for the problem. The imbalance. Now that it knows what the other part knows, it dares not delay.

The end is near.

Also the beginning.

They chased him down in the corridor.

"Dr. Tanner! Wait! It's us!"

Sonya pinned Tanner to the bulkhead with disturbing swiftness, her feet anchoring the two of them in the weightlessness. Tanner struggled, but when Felicia drifted toward the pair, he seemed to relax.

"Sam?" she asked. "Don't be afraid. We won't hurt you." It seemed ridiculous to be talking this way to an old man, but Tanner's eyes darted from side to side, and Felicia knew that the man behind those eyes was not the Samuel Tanner she knew.

"Sam, we've come to help you." Felicia touched his shoulder and smiled. "You remember us, don't you?"

"Don't be thick," Sonya hissed. "Of course he—"

"Shut up!" Felicia told her. "Sam. You have to come back to us. You have to tell us what happened."

His eyes fastened on her. "Felicia. Robert's daughter. He . . . said you would come . . ."

Sonya continued to hold him in place, her muscles taut, her face impassive. Felicia squeezed his shoulder. "Sam, where are the others?"

His eyes widened again. "It was . . . the

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Cyclopean . . . the Cyclopean . . . is . . . awake!" He started thrashing around so much that he almost broke free.

Felicia let herself drift away from him, and when Sonya tried to restrain him further, Tanner struck, flailing his arms and legs with insane fury. Sonya was hurled across the corridor, where she ricocheted off the bulkhead and thudded into Felicia. When they'd managed to neutralize their momentum, they turned to watch Tanner. He was still thrashing about violently, but he wasn't going anywhere, so they simply waited until he had exhausted his energy and curled into a lifeless ball.

"Poor man," said Felicia.

Sonya rubbed her shoulder. "What could he have seen that would do that to him?"

Felicia looked out the nearest porthole. "The Cyclopean," she whispered.

"What about it?"

"The biggest organism in the Core. Probably the only thing capable of inflicting the damage we saw. One of a kind. The biggest mystery down here."

"Sure," said Sonya. "But it's never been aggressive before, never even *moved* since we began studying it. There's nothing to indicate consciousness, if that's what you're saying."

"No," Felicia answered. "But it has the capacity for it. You remember—Dad was working on it a few months back. The only thing down here with proper DNA, he said."

"You don't think . . ."

By now their minds had fused, as they often did under stress. Felicia found herself knowing exactly what was in her twin's mind.

"That he went out there? There *were* two suits missing."

"Then they—"

"Right. That's it. We have no choice."

"Wait just a second. Aren't you forgetting something?"

"I see it. But surely we have time before the reactor—"

"We don't know that we have *any* time. Face it—we've lost Dad. If he went out there, his air—"

"Don't say it." Felicia was deposited sharply back into her own separate mind with her own separate thoughts. Sonya could be so *stupid* sometimes! "We're not giving up."

Sonya sighed, exasperated. "You wanted my cooperation, right? Well, now it's time *you* cooperated. Face it—he's dead. So's Hernandez. And unless we get out of here fast . . ."

Felicia barely had time to realize that fury was taking her, that it was leaving her rational mind behind and driving her in, across the weightlessness of the corridor, toward Sonya. That she was raising her fists and screaming.

It sleeps for a brief time, saving its energy for the task that is to come.

"Bitch," Sonya said as she blotted at her forehead. Her face was surrounded by a cloud of red blood droplets.

Felicia adjusted the sub's course, making for the last recorded position of the organism known as the Cyclopean. "How's Tanner?" she asked.

She heard Sonya moving behind her. "Still out," came the reply. "I wish he'd been able to tell us more."

Felicia sighed. The image was back, only now her father drifted in a crazy spiral, his arms and legs sheared away, his eyes wide and his mouth frozen in an endless scream.

Something touched her shoulder.

"Easy, Sis." Sonya rubbed her shoulder for only a second before lifting her hand away, and Felicia immediately craved the warming touch. "How're we doing?"

Felicia checked the readouts. "I've got a radar fix on the Cyclopean. At present speed, we'll reach it in one hour."

"Increase our speed."

"What?"

"You heard me. If we're going to do this, let's do it right."

"I *am* doing it right. The ecosystem—"

"Felicia, this whole place will be de-

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stroyed when the reactor goes. Don't you see? So get us *moving*, girl."

Shoals of pink and pastel blue things slid past the transparent canopy as Felicia contemplated the situation. Sonya was right. The ecosystem was doomed. They'd come here to study. Despite their best efforts, now they would destroy instead.

She pushed the throttle forward. Fish and plantlike drifters spattered against the canopy, were sliced in half by the maneuvering fins, mutilated by the rotors. Felicia winced, but she kept the throttle pushed forward. Only the footballs rebounded from the sub's hull, undamaged.

Ten minutes later, the Cyclopean came into view. Tanner began to moan in his sleep. At the farthest reach of the sub's headlights, the rust-colored, spheroid mass rotated like some grotesque, living planet. It wasn't a perfect sphere; protuberances larger than the sub gave it a lumpy, misshapen appearance. Felicia could imagine she saw it breathing, bulging outward and then contracting in a way that was disturbingly sexual.

Sonya whistled. "It *has* grown, hasn't it? Whoever named it the Cyclopean had the right idea."

Felicia shook her head. "What *is* that thing? And why's there only one?"

"It has DNA. You were right about that. I remember Dad saying how it had so many more chromosomes than it needed for an organism of its complexity. Strange, really, when nothing else down here has DNA at all."

A light flashed on the panel. Felicia flipped a switch, scanned visually.

"Oh, no."

"What?"

Felicia focused the spotlights to a point on the Cyclopean's exterior. Two diving suits clung there, partially engulfed by the reddish-brown mass, their strobing red helmet lights signifying oxygen depletion, their limbs stiff and unmoving.

Both the suits were empty.

* * *

It awakens from a strange dream of open sky and an endless horizon and trees blowing in the wind. Alien dreams. That part of it again, stubbornly retaining integrity. Never before has it encountered such intelligence, such force of will.

Now it senses the change. They *are here. They are strangers, yet through that other part, it knows them. Perhaps all urges can be satisfied. Perhaps it isn't too late.*

To reach out.

Felicia wept, her head pressed against the slick plastic of the control panel. It was all over now.

You taught me I could do anything, she told him in her thoughts. *You taught me to believe, to strive, to be stubborn and headstrong and downright nasty if I had to be. Well, I did all that and more, and I still failed. You still died.*

She felt the warmth of someone nearby. For an instant she was disoriented, not knowing where she was or what she was doing.

"It's all right," Sonya said.

Felicia shook her head, wiped tears from her face and flicked them into the air, where they floated slowly across the weightless cabin. "How can anything ever be all right? It killed him, Sonya. That damned thing killed him."

Anger displaced sorrow, but it was a poor substitute.

"Poor baby sister," Sonya said. "You really don't know, do you?"

Felicia cocked her head. "Know what?"

Sonya wouldn't meet her eyes.

"Sonya?"

"It was . . . our secret. Dad wouldn't . . . *couldn't* tell you. Maybe it's better this way."

"Better than what?"

"He was dying, Felicia. Dad had cancer. He'd known about it for almost a year. No cure, no hope. So maybe it's

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better he died this way—doing science, trying to learn, *living*. He died *living*."

Felicia stared, forced her sister to meet her eyes. "I don't believe you. Why wouldn't he tell me?"

"Look at you. *This* is why. You're soft inside. You hide it, try to be like him. Like me. But you're not. You—"

"Shut up! You don't know what I'm like! You're only saying this so I'll think it doesn't matter that he's dead. How stupid do you think I am?"

"Felicia!"

"Shut up! Just shut up!"

Sonya looked down. "Believe what you want. But take us out of here before—"

Something rasped against the hull, triggering contact alarms that filled the cabin with shrill electronic shrieks and flashing red lights. Felicia felt her heart jump. A glance through the canopy told her what had happened.

"It's trying to digest us!"

Brown, fleshy looking stuff was pressing itself across half the sub's canopy, and the instruments indicated it covered the rest of the hull along one side.

"Get us out of here!" screamed Sonya.

"I'm trying!"

The engines roared as she applied more power, but there was no forward progress.

"What's that?"

Felicia looked up. Sonya was pointing to one of the status boards, which showed a numerical sequence being entered into the sub's computer.

"It's the airlock access code," she said. "Something's trying to get inside."

Sonya looked at her, fear in her eyes. "But who . . ."

Their eyes locked.

"That's impossible!"

The status board showed all the digits now. It began to pulse, indicating that the outer hatch was opening. Felicia swiveled up from her chair and propelled herself across the cabin. By the time she reached the inner hatch, it was already swinging open.

"Get back from it!" shouted Sonya.

Felicia froze. The airlock was filled with a semifluid, reddish-brown mass that was obviously an extension of the Cyclopean itself—like a finger poking into a hidden corner to see what was there. It must have foiled the fail-safes, because both airlock doors were open at the same time, which was supposed to be impossible. Only the thing's viscous mass was holding back the water.

"Try closing the door," Sonya hissed. "Maybe we can cut it off or—"

"*Look*."

The mass was undulating now, changing shape even as it maintained the seal that was keeping them alive. As Felicia watched, it began to coalesce into something vaguely resembling the head and torso of a man. Then more waves rippled across its surface, and detail began to emerge.

It opened its eyes.

"Dad!"

It takes in the scene from two distinctly different vantage points. It sees, from the first, two more of the strange, air-breathing creatures that have recently intruded into the womb to set into motion the cycle of change that has already altered its destiny. From the second, it sees the two most precious creatures in the universe, and it feels both joy and intense, inexplicable pain.

My beloved children, *it thinks.* Have I brought you only death?

Sonya's hands held her from behind or she would have rushed into his arms at once.

"Dad!"

"Felicia!" It was Sonya who shouted at her and pulled her back from the airlock. The thing remained where it was, its eyes tracking them as they moved, a familiar smile on its face.

"Felicia," it said, matching Sonya's voice precisely.

"Dad. Is it really you?" Felicia felt tears

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welling up in her eyes, but her body was as stiff as if her skeleton were made of rusted steel, and she could feel Sonya's fingers digging into her upper arms. But it sounded so much like him!

"Felicia," Sonya said firmly. "That's not Daddy. Now help me close the airlock before we die."

Felicia wavered. There was confidence in Sonya's tone, as always, but the heartbreaking expression on . . . her father's . . . face . . .

"No," she said, pulling free of Sonya's grasp. She never took her eyes off the airlock. "Daddy, I know it *is* you. Now prove it to Sonya. She doesn't believe in you the way I do."

He smiled crookedly. "Children. Always fighting. Both all right, though, I always thought. Opposition stimulates creativity. Your sister's right, Sonya. It's me. I've been . . . absorbed. By the being you call the Cyclopean."

Felicia gasped, suddenly realizing what it meant. The Cyclopean wasn't the simple coral reef analog they'd always thought it was. It had a brain, a mind.

"Fascinating ability," her pseudofather said. "It began as a defense mechanism—a creature mimicking some predator, forming an image of it as some Earth butterflies carry the likeness of an owl's eye or a snake's head on their wings. Then the image had to become even more realistic. More predators were added to the repertoire. Eventually, the images became nearly distinct lifeforms—functional copies existing within the fabric of the greater entity. By the time it was over, it had taken all the life of a planet and made it into more of itself. Until it *became* the ecosystem that had created it."

"And now it's got you," Felicia whispered.

"Hernandez is here, too, but he lacks the willpower to resist total incorporation. I'm still separate, a discrete entity within her."

"Her?"

"Oh, yes. I forgot to tell you. The Cyclopean is female, and she's about to reproduce."

Sonya pushed herself across the cabin to the airlock controls. "Bullshit," she said. "Felicia, this thing killed our father, and now it's trying to use his image against us."

Felicia never took her eyes off him. Tears formed in his eyes as he looked back at her. "Remember when you were seven and we went for that walk—all of us—and you made your first botanical discovery?"

Felicia felt her skin tingling.

"Poison ivy," he said, chuckling. "You stayed up all night, studying the leaves under the microscope. And scratching. It was then that I knew science would claim you, both of you, as it had claimed me so many years before."

Sonya was shaking her head. "That only proves it's copied his memories as well. Copied them from his corpse."

"Sonya!" Felicia's own fury surprised her. "Stop being so stupid and *listen*. It's Daddy. He's trying to help us."

They both looked at him then. There was compassion in those eyes, but there was also the look of painful knowledge. "There may not be time. I cut the cable to bring you down. Knew you'd both find a way to get on the rescue team. Couldn't just cable the news. No one would believe."

"Believe what?" Sonya asked. It was the first time she had spoken directly to him.

His expression grew more serious. "You must return immediately and evacuate everyone from the surface. Tethys is going to . . . die."

Felicia let out her breath in a long sigh. "The reactor?"

"I set it to overload. The only way, now. Otherwise, death."

She stared at him. "*You* set it? Why? The Core will be destroyed—everything in here will be boiled alive. You aren't my father. My father would give his life to save this ecosystem."

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"Your father already has," he said. "Understand, both of you. The Core isn't an ecosystem—it's a single organism. Like a cell. The Cyclopean is the nucleus. No DNA outside her, remember? She is the brain, and she lays the eggs. Impervious to anything. She dies, when the cycle is complete, but they are cast out into space, millions of them, searching, seeking."

"The footballs." Felicia heard the voice, barely recognized it as her own.

"Normally," he said, "she would wait. Infinite patience. Cataclysm, volcanic eruption, collision with another moon or an asteroid. These are the modes of transmission. But we ruined all that."

"We upset the balance?" whispered Sonya.

"SciCorp was careful to prevent human contamination of the Core. Hulls of insoluble metals and plastics. Waste transported to the surface. Nanodiamond coatings on everything. But we're shortsighted creatures. We didn't realize the long-term effect of our presence. Accidents occur. Even if they don't, we were pumping energy into the system—energy that had no place to go. Our *light* would have been enough to destroy the Core eventually."

His body lost definition for an instant, then a spasm seemed to pass through him, and his features clarified again. "The decision has been made."

Felicia sensed understanding hovering at the edge of her awareness. "The reactor. An artificial catastrophe?"

He smiled. "Humans created the problem, but they also provided the solution. Ironic, don't you think? The explosion will shatter this moon. The eggs will be dispersed. We will continue."

"No," said Felicia. "We can do it better. Tell me how to shut down the reactor. We'll take the eggs and—"

"Too late," he said. "Thought of that. But she would never trust humanity that far. Does an animal allow you near its young? I held it back as long as I could. But I'm part of it. This is the only way. Now go. Warn the others. See to the evacuation. Time slips away quickly."

"We'll do it," Sonya said.

Felicia shook her head. "Like hell we will. I'm not leaving you down here, Dad. There must be another way."

"Felicia. Sweet Felicia. Don't you get it? Your sister is right: I no longer exist. Not as your father. I died when my suit was ruptured."

"That's not true."

"Perhaps not entirely. Still, if it *is* me, then I'm your father and you must obey me this one last time. See? You can't win. If it's any consolation, I understand how hard it must be for you."

Felicia felt suddenly angry with him. "Understand? How could you? You're asking me to kill you. Even if you aren't all . . . you, there's *something* left. That will be lost the instant the reactor blows."

It looked like admiration in his eyes, but it also looked like he was seeing far into the distance. "I won't die. I'll never die. The eggs. What we called the footballs. You noticed the increase, no doubt. Seventy percent of them formed after my absorption. I'm in them—biologically encoded. I may well outlive the human race itself." He glanced at Sonya. "You know how little time I had left."

Sonya nodded.

"It's true?" asked Felicia.

"Yes," he said. "Your old father's body was malfunctioning. Death would have come soon. This way I'll survive, somewhere out there. All it takes is a single egg to start the cycle again."

"But . . ."

He started to reach for her, stopped himself. "Felicia. You were always the conscience of the family. Believe what I tell you. I'll survive within her descendants for all eternity. And I'll survive in you. There's a lot of me in you—my curiosity, certainly my stubbornness. Do me one favor, will you?"

She just looked at him.

"Don't go through the rest of your life trying to *be* me. There's *you* in you, too.

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If you look hard enough. If you stop hiding from it."

She wiped at a tear that had formed in the corner of her eye. He turned from her then.

"Sonya. So like your sister . . . and so unlike. I ask of you only one thing. Learn how to cry."

His eyes turned inward, as if he were listening to a voice only he could hear. When he looked back again, there was urgency in his expression.

"You must go now. The lives of everyone on Tethys depend on it. Get them away from this place."

"What if they won't listen to us?" Sonya asked.

"They'll listen. Tanner's condition will support your story. And you can be . . . persuasive." He chuckled. "Besides, when they see the two of you in agreement, they'll *know* something strange is going on somewhere."

Felicia smiled. The form of her father faded again; this time it seemed to take more effort for him to reestablish it.

"I must go now," he said. "One more thing, girls. When you return to Earth, find your mother and tell her . . . tell her I'm sorry. She's a good woman. I hope neither of you blames her for her decision. I'm a scientist. That love comes first, always, drives me to these remote places. She didn't have the heart for it. So tell her. Maybe she'll understand at last."

This time he faded for good. The brown mass began to pulsate. For a second, it seemed to move forward. Then it withdrew from the inner airlock hatch. The hatch closed. A glance at the status board told Felicia that he was gone.

"It's released us," Sonya reported. She'd taken her station and was checking the instruments. Felicia felt numb.

"Let's get moving," Sonya urged.

"I can't. I can't leave him."

Sonya moved to her side, silent in the weightlessness. "You have to," she whispered.

"But—"

The sub rocked violently.

Sonya laughed. "You can't ask for a clearer sign than that."

"What do you mean?"

"Dad. Just like when we were kids. When he needed to get us moving and we were sitting on our hands, he'd give us a kick in the pants."

Felicia looked into her sister's eyes, and she knew it was true. It was time to go. There was no chance of retrieving him; she knew that now. Maybe it was better this way.

"All right," she muttered as she took her position and began preparing the sub for the return voyage. "Make sure Tanner's strapped down tight. We're starting our ascent."

It takes that other self back inside it, looks at it more closely than before. Here are emotions as fascinating as thoughts. Here are ideas both wonderful and strange.

It will be an interesting synthesis.

For now, it is content. One seed in a million, blown through space and a long sleep to finally come awake inside this island of ice circling a planet far from its dim sun. So it will be again. And to the chorus of ancestral voices that sings inside its awareness, one new voice will be added.

It rejoices. The cycle is complete and the long waiting is done. This is no ending, when the work of eons is complete, when death comes here and life is once again flung to the stars.

It is a beginning.

Now.

The stars burned with impossible brightness beyond the observation deck's great oblong window. Sonya and Felicia stood apart from the others, but distance couldn't drown out the grumblings of anger, disbelief and distrust.

"They'll have our butts if nothing happens," Sonya observed.

Felicia watched as the last of the smaller ships cleared the surface of the

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moon that hung amid those too-bright stars. She could see Sonya watching her in the slice of deck reflected in the window, but she could think of nothing to say to her sister just then.

Raised voices made her look once again at the moon.

"It's happening," Sonya whispered.

Felicia watched as Tethys became fuzzy, almost like it was growing a beard. A thousand ice volcanoes were erupting all at once, on every part of the surface, as the internal pressure forced the liquid core outward.

"It's beautiful," she sighed.

The water froze instantly when it hit vacuum. Plumes of ice rose first dozens, then hundreds of kilometers into space, radiating in every direction, turning the moon into a starburst. Saturn washed the whole thing in a soft, pearly light, bringing out subtle hues of pink and blue. For many minutes this continued. Faces watched the sight in awe, an almost spiritual silence descending on the observation deck.

Then, more abruptly than she'd expected, it subsided. Tethys had expelled its core. For long seconds after the plumes had vanished, they all watched in silent anticipation. The hollow shell could not hold. Cracks appeared in the surface, spreading and connecting faster than the eye could follow. Plates of ice broke free, tumbling slowly inward. In time, Felicia knew, they would form a new, much smaller moon. What was left would be drawn out through the orbital plane—a new set of rings far beyond the others.

And among them, Felicia knew, would be darker things—brownish, oblong things that resembled nothing so much as overinflated footballs. And within each of them . . .

She heard a sniffling sound and turned. Sonya stood beside her, looking out at the cloud. Her cheeks were wet with tears. Felicia stepped closer and took her sister's hand.

"It's OK," Sonya said as they both looked out at the spreading cloud of ice. "Dad'll be OK."

Felicia squeezed her hand tighter. "I know," she said. From that time forward she always felt he was with her, watching over whatever she did. And when she looked to the sky at night and saw the frozen light of the stars, she spoke to him there.□

In loving memory of
John G. Manison
1923-1997

MOVING?

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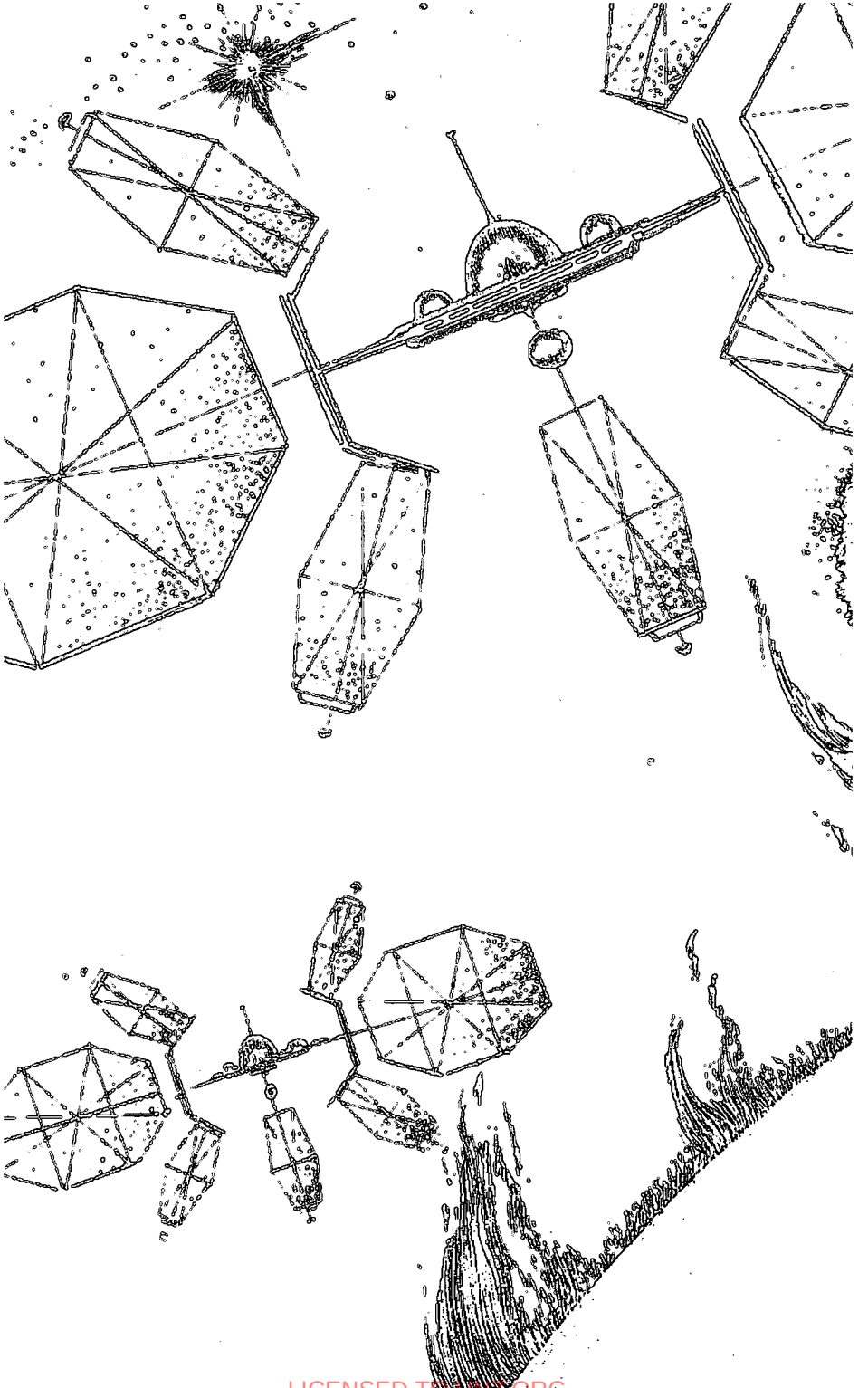

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James Gunn

POW'R

Gifts are not always used as the giver intended. . .

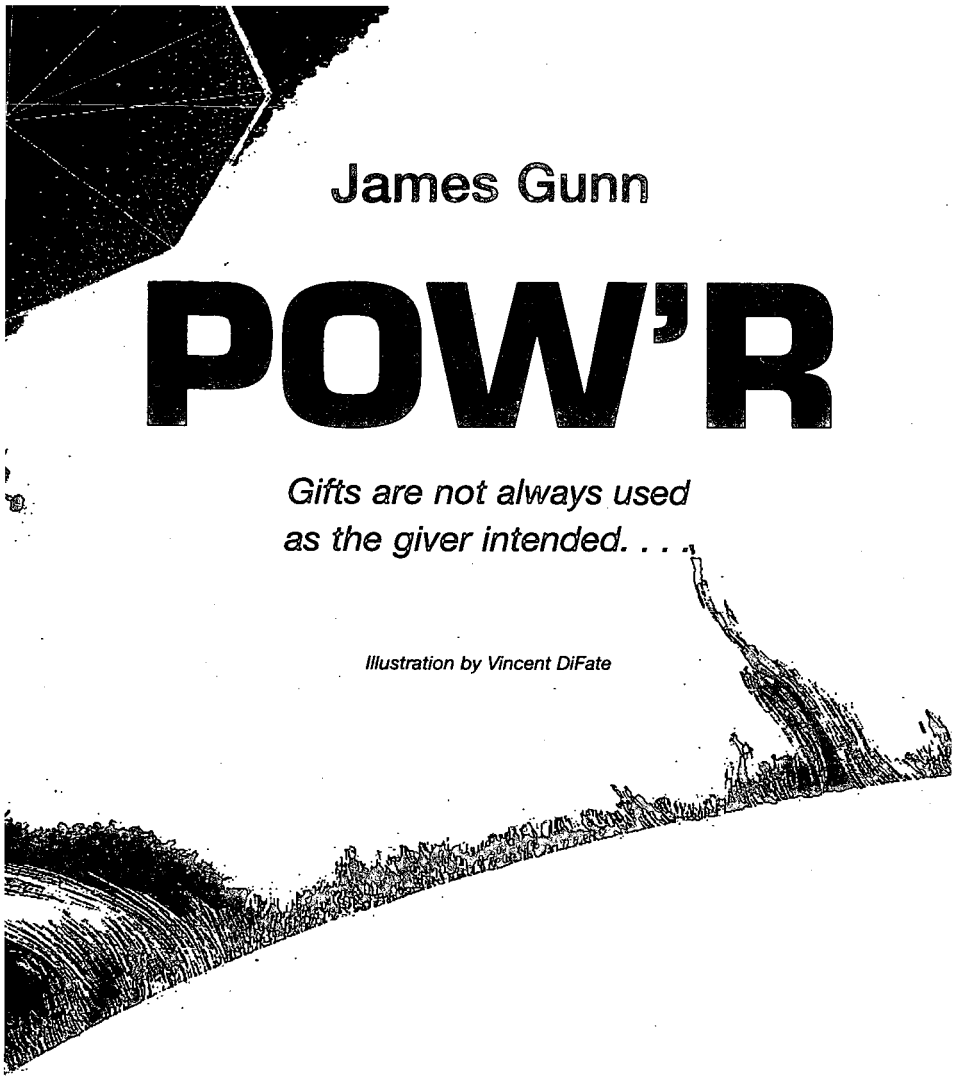

Illustration by Vincent DiFate

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I sell what all men desire.
—Matthew Boulton

The objects were black against the overwhelming brilliance of the Sun. Hovering just outside the coronasphere like moths drawn to a flame, their wings seeming to flutter in the solar wind, they maintained their positions and their existences against the elemental forces acting upon them. If they had been alive, they would have been unbelievable evidences of the variety of existence, but they were even more remarkable: they were machines built from alien specifications to liberate humanity from the solar system in which it had been imprisoned. They were a gift from the stars.

Frances Farmstead replayed the tape, but this time she let it continue until the end, when a shape like a transparent shark drifted across the screen. The Sun shone through the image almost undiminished, and the black moths could still be distinguished if she peered, but something halfway between an afterimage and a sketch crossed in front of the Sun and the mechanical creatures sucking its energy. It was a ship—or the Platonic idea of a ship—where no ship existed, like a reminder of a promise unfulfilled, like someone walking across her grave.

Frances looked around the shop as if comparing it with a book store she once had owned. But this was spacious where the Book Nook had been narrow and quiet, and the books that had stood at attention upon shelves and stared at the ceiling from tables had been replaced by the backs of video tapes and the jewel-boxes of CD-ROM disks. Between the shelves were classic movie posters framed in white: *The Day the Earth Stood Still*, *The Thing*, *The War of the Worlds*, *Attack of the Flying Saucers*, *Independence Day*, *Contact*, and *Star Wars: The Final Victory*.

Frances had outlived her husband and her son, and her daughter had stopped communicating after Frances had opted for rejuvenation, and now Frances had outlived the age of reading.

She sighed, as if coming to a decision, and spoke to her computer. "Phone Adrian Mast," she said. She could hear the connection click and then the telephone begin to ring, but the screen remained blank. After three rings, the sound stopped and a computerized voice announced, "This number is no longer in service. For directory assistance consult your local website."

"Directory assistance," she told the computer. After a few moments the computer said, "Directory assistance has no listing for Adrian Mast."

"Locate Adrian Mast using all available databases," she said. She tried to suppress a feeling of alarm. The minutes passed slowly.

Finally the computer spoke. "I have identified eleven Adrian Masts, but none is the person you seek. As far as my resources can determine, that person does not exist and has never existed."

Typical computer literalness: how could a person have never existed if the computer had parameters to match? But that misplaced irritation was only Frances's effort to avoid panic. With Adrian she had hunted down the author of a UFO cult book in which Adrian had found what looked like, to him, working designs for an alien spaceship. Now Adrian had been eliminated from all the world's records.

It was like an Alfred Hitchcock movie. Why should Adrian disappear? Someone had gone to a great deal of effort to delete all traces of him. As if Adrian were—what? The man who knew too much?

Frances looked up at the posters on the far wall and then back at the computer. She idly tapped a few keys and then deleted the gibberish that appeared on the screen. Once people had reasons to get rid of Adrian. She and Adrian had tracked down the author of *Gift from the Stars*, a man named

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George Winterbotham, whose real name had been Peter Cavendish, but he had been certifiably psychotic. Even paranoids have enemies, however. When she and Adrian had figured that out, they had been summoned to a confrontation with the Buddha-like William Makepeace. Makepeace had warned them that, for the peace of the world, the spaceship designs must remain a secret. But she and Adrian had already released the designs and the government had to claim credit for the action or fall fatally behind in the alien technology race.

But that was ten years ago, and nothing had happened since. Well, a great deal had happened to the world, but nothing had happened to Frances and Adrian except that they had drifted apart, once their adventure had ended. The alien technology had worked; devices were orbiting the Sun. Solar moths were transforming the Sun's energy into high-energy gamma rays and beaming them back to receivers in orbit where they were converted into antimatter. The entire process was marvelous beyond understanding, but seeing was believing, like the creation of an electric current when one rotates a wire through a magnetic field or the illumination of an incandescent filament when a switch is turned. The documentary recently on her screen had mentioned "magic crystals" constructed of "strange matter," and the only thing that made it credible was that aliens had sent the plans and human scientists had blinked and then said it was possible. Power was available almost everywhere for almost nothing because in space the antimatter was combined with matter to create energy that was beamed to receivers on Earth that rebroadcast it around the world. . . .

That was all accomplished now, faster than anyone had thought possible, and everybody was rich and happy. The world was a different place. Space travel had been pushed aside, to be sure, but that was no reason for Adrian's disappearance. He was only a small voice unheard against a general background of self-satisfaction.

Only—if this were a Hitchcock movie, something else should be happening about now.

As if that were a cue, the door swung open, and a man and a woman in one-piece gray suits, like ill-matched twins, were inside the shop, not so much entering as materializing. They displayed no weapons, but their hands alone looked lethal. "You'll come with us," the woman said as if there were no question of noncompliance.

The man seated behind the ancient metal desk was tall and thin to the point of emaciation. His dark eyes seemed too large for his face. Frances thought of the movie *Freaks*, but in real life people couldn't stare unless they had paid admission. She looked away uncomfortably and studied the room; life was like a movie set—a person could tell a great deal about a character from his surroundings and even anticipate the actions that were going to happen. But this place offered few clues. It was a second-floor office in a twenty-five-story building in what had once been a thriving suburban business development. As the suburbs had sprawled farther into the countryside, they had dragged the administrative centers with them, but now the virtual office had replaced the old vertical units with their requirements for transportation and elevators and air-handling equipment and toilets and food and drink.

The office to which Frances had been escorted by the improbable twins matched its location. Its windows looked out upon buildings being razed and land returned to meadow and park. A shabby sofa covered in something that looked like green leather stood against one wall, and equally shabby side chairs occupied each end of a battered wooden coffee table. Above the sofa was a tat-

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tered poster of a bullfight in Mexico City. On the opposite wall was a reproduction of Van Gogh's "Sunflowers."

"Well, Mrs. Farmstead," a voice said from behind the desk, "are you pleased with what you've done?" The voice was strangely familiar.

Frances looked back quickly. "Makepeace?"

The skeletal man nodded.

"What have they done to you?" The last time Frances had seen William Makepeace he had been an immense fat man, like Sidney Greenstreet in *The Maltese Falcon*, in a vast, empty hangar.

"The same thing they did to you," Makepeace said. "Or we did to ourselves. We shed our weight with biogenetic help. With me the pendulum swung a bit too far; on you it looks good, and the rejuvenation process seems to have served you well."

"I cut my hair," Frances said absently, touching her gray bob. "But what are you doing here? The national government is virtually out of business."

Makepeace looked down at his bony hands. "A good bureaucrat can always find work. A good bureaucrat is someone who does his job efficiently and quietly, accepts blame for whatever fails, and passes along any credit to his superiors. Now I serve the Energy Board."

Nobody pays attention to the administration of utilities as long as whatever they supply is cheap and uninterrupted. But Frances had heard of the Energy Board. She remembered vaguely that it was governed by five Chairs, each representing his or her continent and overseeing its distribution of the energy stolen from the Sun.

"You asked me if I was pleased with what we had done, Adrian and I, and I presume you mean the world we created when we released the alien designs. And my answer is that the world has managed to absorb alien technology without a tremor."

"Proving that you were right and the rest of us were wrong," Makepeace said.

"So it would seem. Has the world ever been in better shape? Energy is being broadcast from mountaintop receiving stations, global warming is being reversed, pollution is being cleaned up, and the quality of life around the world is being raised to Western standards. People everywhere are happy and prosperous, education is universal, the arts are flourishing, the ghettos are being depopulated and demolished, the birthrate has dropped to a supportable level—what's not to like?"

"A virtual paradise," Makepeace said, as if in agreement.

Frances looked at Makepeace. "Virtual? Maybe that's the right word: utopia may not be here yet, but it isn't unimaginable. The only thing on which we haven't made any progress is spaceflight. No matter what we do, nobody will let us build a ship."

"You can't expect people to get excited about space when they have everything they need here on Earth," Makepeace said.

"That's one of the problems with paradise, isn't it," Frances observed. "No one wants to leave."

The ceiling lights above them went dark. Frances twitched, but Makepeace sat unmoved, as if the occurrence were commonplace. The only light came through the windows behind him.

"If it's paradise," Makepeace said, "why are crimes of violence and acts of terrorism on the increase?"

"That's news to me."

"And to most people. In good times bad news seems to drop below the horizon. Nobody notices."

The overhead lights came on again.

"Or maybe it doesn't get reported," Frances said.

"Censorship, Mrs. Farmstead?" Makepeace said. When he shook his head, it looked as if it might fall off his pipe-stem neck. "No need, and no means. The Energy Board is in the business of distributing energy, and it has no facilities for controlling the media. And even if it

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could, so much is available on the Internet that omissions in the media would be obvious. The answer is that nobody is paying attention."

"Except you."

Makepeace nodded carefully. "A few bureaucrats like me are paid to keep track and to ask why these things are happening."

"You didn't get me here to get my opinion," Frances said flatly.

"Adrian Mast has disappeared," Makepeace said.

"So I found out. And there is no proof he ever existed."

"No electronic proof," Makepeace said.

"What do you mean?"

"It's not easy to delete physical evidence, written documents, files, that sort of thing," Makepeace said. "No one can work magic. But we've become dependent on electronic information, and a search program with instructions to eliminate anything it finds can remove the most available evidence of a life. But why would anyone do that?"

"I thought it was you," Frances said. She made a sweeping gesture that included the office and the bureaucracy it represented.

Makepeace shook his head. "Maybe it was Adrian himself."

Now it was Frances's turn to look skeptical.

"Aliens?" Makepeace suggested.

"That doesn't make sense," Frances said. "Why would they send us plans if they were here already?"

"To throw us off the track?"

"I still think it was you," Frances said, "or someone who looks a lot like you, or like you used to look. But whoever it was, I'm going to find out."

Makepeace looked as pleased as his death-mask face could manage. "I hoped you would, Mrs. Farmstead," he said.

Frances studied the cabin nestled in a grove of oak trees. A lot had happened to her and to Adrian in ten years, as well as to the rest of the world. Consultants seldom needed to meet in person with their clients any more, and Adrian had retreated from his urban apartment to this rustic isolation. Frances had visited his apartment a couple of times, but Adrian's move had been part of the distancing process that had resulted, over the past half-dozen years, in little more than holiday greetings. She hadn't even known he had moved until she had inquired for him at his former building.

Now she wondered whether she had identified the situation correctly. Maybe it wasn't a Hitchcock scenario after all; maybe it was a horror story or a mystery. It was important to get the genre right. Otherwise you wouldn't know what to look for or how to behave.

The cabin had no close neighbors. The taxi that had brought her had passed a few farmhouses along the way, but none was near enough for its occupants to keep track of Adrian's coming and goings. Here, far from the city, Frances missed its busybodies. In the police shows, neighbors witnessed whatever happened at any time of day or night; the difficulty was persuading them to talk. Maybe that was what Adrian had been looking for: anonymity. The only community that mattered to him was scattered around the world and had only a faint hope of coming together, some day, out among the stars.

Finally, after circling the house and finding only a browsing rabbit to startle into leg-kicking terror and a quail that exploded from some underbrush, Frances decided to go in. The door was unlocked. In the movies an unlocked door was a cue for the detective to draw his pistol and sidle cautiously into the room beyond, steadying his weapon with both hands, aiming first one way and then the other. But she had no weapon, and she swung the door open and walked in, uncertainty fluttering in her stomach.

The doorway opened directly into a living room. It had smooth painted

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walls, casement windows, and a hardwood floor—not at all like the inside of a cabin; it was one thing to desire the rough-hewn honesty of a cabin and another to live in one. The only concession to tradition was a big fireplace set into the left wall; in front of it was a rag rug and a sofa upholstered in multicolored tapestry, with matching chairs at each end. A desk, with a closed laptop computer on top, stood against the opposite wall. Beside the desk, a lawyer's bookcase with glass fronts held three shelves of eclectic books. No one else was in the room, and everything was neat, the way Frances remembered Adrian's apartment, as if the cabin had been untenanted since he left or was taken.

Two doorways, one with a closed door, occupied the far wall. She opened the door to the one on the left. Beyond was a bedroom with an adjoining bath. The bed was made and the bedroom was empty and neat; so was the bath, with folded towels draped in racks. The shower was dry. The other doorway led to a kitchen and breakfast table with four chairs. For the first time Frances noticed something out of place; the remains of breakfast dishes cluttered the table: a bowl, a box of cereal, a mug, a spoon. The bowl was empty, but the mug was half full of cold coffee; a sheen of oil floated on top.

Adrian had been interrupted just after breakfast but before he had finished his coffee. She went back to the living room and sat down in one of the tapestry-covered chairs, frustrated. So big a problem; so little information. She thought back to her earlier observation about the cabin: identifying the genre was essential. Each had its peculiar protocols, and if you didn't ask the right questions, the answers you got would be either irrelevant or misleading.

So, she thought, this was a mystery, and she needed to ask questions about motivation. The first possibility was that Adrian had left of his own volition interrupted by a message or a messenger, with a summons so urgent his morning coffee couldn't be finished. But what was so urgent that a man as organized as Adrian couldn't finish his coffee? Or leave a message? The second possibility was that he had been abducted. The room revealed no sign of a struggle, but that wasn't conclusive: he could have been surprised at the door or compelled to leave by overwhelming odds or weapons.

She looked from the fireplace to the computer on the desk against the opposite wall. She stood up and walked to it, released the catch, and raised the monitor into place. She pushed the power button. When the icons swam into view, she called up Adrian's files. A numbing array of folders appeared on the screen. Adrian had been busy. The titles seemed to describe reports related to his consulting business; a few of them seemed to deal with his plans to build a spaceship. She could come back to those later, if necessary.

She returned to the icons and clicked on his e-mail server. Unlike the programs themselves, this one required a password and clicking on "okay" did no good. She tried several passwords, including her name, her birthday (did Adrian know it?) and his, recalling that unlike Adrian she had sent him greetings on those occasions, "Winterbotham," "Cavendish," "stars," and "space." Then she tried "giftie," and the files opened.

There were a few messages waiting to be read, all dated in a two-day period that began six days ago and ended four days ago. The date Adrian disappeared and the date he had been eliminated from humanity's electronic memory? Frances scanned the messages; all but one related to Adrian's consulting business, and the remaining message said only "Haven't heard from you in a couple of days. Are you okay?" It was signed "Jessie."

The register was empty of messages sent and received earlier than six days

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ago. That was suspicious. Of course Adrian could have deleted his messages as they were read or sent, but that didn't make a lot of sense. At least some of the messages related to his business must have been worth keeping, but someone else, particularly someone in a hurry, would have deleted everything.

But what they might not have known was that deleted messages remained in the trash until they were squeezed out by new deletions. Frances was about to retrieve them when she was interrupted.

"What are you doing here?" a woman said.

Frances turned to see the shape of a woman outlined in the doorway. As the woman moved into the cabin with athletic grace, Frances noted with a pang that she was slender and dark-haired, and, with a sharper pang, young and attractive, in a tomboyish way. Frances pushed those feelings away: she would never be any of those things again.

"I might ask you the same question," Frances said.

"I'm Adrian's girlfriend."

Frances looked her up and down. She was dressed in jeans and a yellow t-shirt. Adrian was fifty-one, and this woman could not be more than, say, twenty-five. Frances could sense the young woman flushing under the scrutiny, but Frances didn't care. More was at stake than the feelings of strangers. "I doubt that."

"Well," the woman said defiantly, "we're very close."

"For people who have never met," Frances guessed.

It must have been shrewd, because the young woman flinched. "We were e-mail correspondents. When he stopped responding, I decided I'd better check up."

"'Haven't heard from you for a couple of days. Are you okay?'" Frances quoted.

"How did you know?" the young woman asked.

Frances gestured at the laptop. "You look like a Jessie."

"That's me," the woman said. "Jessica Buhler."

"And you flew halfway across the country to check up on your e-mail friend."

"How did you know?" Jessica said.

"You don't get a tan like that around here," Frances said. "Florida?"

"California. Near San Diego. But you haven't told me who you are."

"A real friend of Adrian's—Frances Farmstead. Like you I got concerned when I couldn't get in touch with Adrian, and I got really concerned when I discovered that he didn't exist."

"He didn't exist?"

"Not according to all the electronic records."

"No!" Jessica said. And then, "Adrian has mentioned you." Now it was Jessica's turn to appraise Frances. "He said you'd helped track down the author of the UFO book with the diagrams. That's how we got acquainted, on a serve-list for spaceship enthusiasts."

Frances wondered, for a moment, why she hadn't been included on such a list. "You don't look like a spaceship enthusiast."

"What does a spaceship enthusiast look like?"

"Strange," Frances said. "Like me."

"That's odd," Jessica said. Then, "I mean, why should someone who wants to build a spaceship be strange?"

"You look like someone who could get plenty of satisfaction right here," Frances said. "You wouldn't need to leave Earth."

"You don't know me. The question is—where is Adrian?" Jessica continued. She looked around the room as if he might be lurking somewhere.

"That's what a number of people would like to know. The government suspects aliens; I suspect the government."

"Aliens!" Jessica echoed. "That's the way I said it," Frances responded. "Oh,

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aliens might have the motivation; they sent us a ticket to the stars and we cashed it in for creature comforts. They could be screwing things up, casting an occasional sabot in the machinery of our joy. But why send us a design if they're already here? And they sure aren't going to be interacting from a distance of dozens of light years. On the other hand, Adrian might be an annoyance to the people who don't want our peace disturbed."

Jessica stood as if poised between attack and flight. She had, apparently, never before considered either of these possibilities. "Aliens!" she said again. Then, heading for the door, she called over her shoulder, "Maybe that explains it."

"Explains what?" Frances called after her. When Jessie didn't reply, Frances trotted to catch up.

Jessica led the way to a meadow beyond the circle around the cabin that Frances had made before she entered. "This!" Jessica said, pointing.

Frances stood beside the young woman, panting. In front of them was a circle of burnt and blackened grass, about fifteen meters in diameter. Frances looked at it, puzzled.

"See?" Jessica said.

"You see," Frances said, absently, "but, as Sherlock Holmes said, you don't observe." What she couldn't see was the scenario this evidence fit. Oh, clearly it would fit an alien abduction category, but the questions to be asked seemed to hang in the air, unsupported, and to suggest no good answers. It was the wrong genre. She looked up and started back toward the cabin, ignoring Jessica trotting along beside her, trying to talk about aliens, when she saw the smoke. She ran as fast as she could, but Jessica got there before her and stood looking at the flames already rising above the back of the cabin.

"My god!" Jessica said. Frances brushed past her. Jessica tried to grab her arm. "What are you doing?"

Frances ran to the front door, raised her arm across her face and over her mouth and nose, and went through the open front door. The room was filled with smoke pouring through the kitchen doorway. Frances felt her way to the desk. She grabbed for the computer. It was hot, and she almost dropped it as she picked it up, but she yanked it free from the cord plugged into a wall socket. She turned and staggered toward the front door.

As she was fumbling her way through the smoke, a hand reached out to guide her into the sunlight and the open air. She stood, shaking, gasping for breath, the laptop dangling from her right hand.

"That was crazy!" Jessica said.

"We had to have it," Frances said. "It was our only clue. And somebody wanted it destroyed."

"Or some *thing*," Jessica said.

They stood outside the Visitor Complex, the evening Sun over their left shoulders, sinking toward the remote Gulf. They knew it was the Visitor Complex because the signs along Highway 3 had announced it for the past few miles, and the sign high on the building read:

"KENNEDY SPACE CENTER,"

and under that

"VISITOR COMPLEX."

But under that someone had stenciled:

"Abandoned in Place."

The entrance to the facility was overgrown by vegetation and cluttered with debris. The Space Center had indeed been abandoned and apparently for several years. A chain-link fence topped with barbed wire met the building on each side, and the doorway had been covered with plywood and nailed shut. Frances saw no way into the building or around it. Maybe Jessie could scale the fence, but Frances knew her limitations. And once they were inside, the Space Center was too big to cover on foot.

"Are you sure this is the place?" Jessie said.

"Clues never produce certainty,"

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Frances said. "The detective accumulates evidence and plays hunches based on subconscious juggling of that evidence, like Perry Mason and Nero Wolfe."

"Who?" Jessie asked.

"Never mind. Anyway, we've been over this too often: Adrian was exchanging e-mails with people about alien spaceship design and petitioning the Energy Board for resources to build one."

"And then there were those curious messages chastising humanity for not getting construction started," Jessie said.

"No way those could be from aliens," Frances said decisively. "Not in English. Not from the distance of the stars. Not signed 'KSC.' That could stand for a lot of things, but the most obvious meaning is 'Kennedy Space Center.'"

"Only it's abandoned."

"Just as the world has abandoned space," Frances said. "This has to be the place. It just feels right."

It had felt right all the way down from Atlanta in the rented car, to Macon on 75 and on 16 to Savannah and then down the coast on 95 to Jacksonville, Daytona Beach, and Cocoa, before switching to highway 3 and heading back north to KSC. It had felt right when they passed a junkyard that looked like an old Emshwiller painting, with a Redstone rocket, several dilapidated rolling camera platforms, and the remains of what looked like a supersonic transport. A junkyard, that was what the space program had become, and now the facility that had made it possible had been abandoned in place.

The only thing that hadn't felt right was Jessie Buhler beside her all the way, talking, insisting that she couldn't go back to California without finding out what had happened to Adrian. But now here they stood, not far from what felt right, and they couldn't get in.

Still chattering, Jessie pried at the plywood without success. Finally she gave up in frustration. "If you're right about this place," she said, "there must be an entrance where people can *drive* in and out. They would need food and other supplies, and that requires frequent and easy access."

"They might use airplanes or helicopters," Frances said. "Landing strips may be abandoned, but they're still in place."

"People would notice air traffic," Jessie said. "But not a car or truck."

Frances looked at Jessie with new respect.

"So let's look," Jessie said, getting back into the car.

They drove back to the road. The Space Center was on a barrier island between the mainland and the thin strip of beach that ran from Cape Canaveral down to Melbourne, with the Banana River on the east and the Indian River and a National Wildlife Refuge and its swamp on the west. One road entrance was overgrown with vines and clearly had not been used since the station was abandoned. An alligator was sunning itself on another, and nothing could persuade Frances to disturb it. A fallen tree blocked a third entrance, and a fourth, available only from Titusville, was cluttered with debris that might have been left when the Indian River overflowed or a hurricane had passed.

The entrance from Titusville was guarded by the omnipresent chain-link fence and a sliding chain-link gate with a drab beige booth beside it. Frances edged the car up to the gate, trying to avoid the worst of the debris. The gate looked rusty and dirty as if it hadn't been used in months or even years. "Take a look," she told Jessie.

"Why me?" Jessie asked.

"You're younger and quicker," Frances said.

Carefully searching the ground before each step, Jessie finally reached the gate. She looked back. "It's locked," she said.

"Give it a yank anyway," Frances said.

Jessie pulled at something Frances couldn't see and then turned around holding something in the air. "Either it

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was broken or only meant to look locked."

"The power must have been shut off long ago. Push the gate open," Frances said.

Jessie pushed. The gate slid back smoothly as if it had been oiled recently. "Looks like you were right," she said, as Frances rolled the car through the opened gateway and Jessie got back into the car.

"Either that or someone else is holed up here," Frances said. She stopped the car on the other side of the gate. "You'd better shut it."

"Not me," Jessie said, shivering. "I hate wild animals. And anyway, we may need to leave in a hurry."

They headed across what once had been a bustling complex that had specialized in hurling men toward the Moon. Now it was a vast, silent sea of concrete in which their car moved like a tiny bottle tossed into the ocean.

Only it wasn't empty. Weeds, some of them as tall as bushes, had grown up in cracks. Little brown wild pigs scattered in front of them as the car approached, and here and there a wild boar snorted at them, trotting from behind a building to assert its territorial rights. Armadillos lifted their heads from their inspection of the ground and sidled away when the car got close; alligators didn't seem to care, although they heard a distant roar. Vines and small trees reached from the Indian River to reclaim the land from civilization's efforts to pave it into submission. Woodpeckers pounded trees for insects. Rattlesnakes sunned themselves on ledges and in empty patches of concrete. Eagles soared overhead, and occasionally, flapping through the darkening sky, a snowy egret. Insects splattered against the windshield and threatened to invade the interior through closed windows.

"When they say 'abandoned,'" Jessie said, "they meant returned to nature and the native populations. It certainly doesn't look as if anybody has been here."

"Don't forget the gate," Frances said, but she looked lost as well. Where on these roads, among these enigmatic structures, would a band of kidnappers hide?

She felt the abandonment of this place, the loss of purpose that the buildings and the stretches of concrete had once expressed, the bustle of people and vehicles that had expressed the human will to conquer space, the roar of massive engines that had shouted their defiance at the Earth that kept its offspring tied to its apron strings.

Over on the Cape side, a couple of hundred yards from the beach and the blue Atlantic ocean beyond, were the remains of a launch pad. Half-a-dozen twenty-foot concrete and metal arms supported a doughnut ring of concrete and exposed metal. The metal parts wore a patina of age and despair. An "abandoned in place" sign was stenciled on one of the slabs. Another slab had a plaque attached to it. Frances didn't get close enough to read what it said. The entire place filled her with melancholy, like a space-age Stonehenge raised to forgotten gods, and the plaque, she had the feeling, was inscribed with the names of ancient heroes.

Frances pulled to a stop, with their backs to the ocean, facing the vast Space Center complex with its roads and runways and buildings. "I don't know where to look," she said. "We could spend a week here and still not exhaust the possibilities."

"What about that place?" Jessie said, motioning toward a huge square structure that towered in the middle of the Center, dominating the entire complex. "It's big enough to hide a small city."

"That must be where they assembled the big rockets," Frances said. "Well, why not?"

She headed back toward the massive building. It loomed even bigger as they approached, until the top reaches seemed to disappear into the blue sky.

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Most of it was white with darker panels. As they got closer, they could see some low outbuildings. On one side a gigantic American flag, perhaps two hundred feet tall, had been painted. Then came a dark panel inset with a lighter rectangle and, on the other side, a huge NASA symbol, once dark blue, now faded. Temporary structures surrounding the building had deteriorated and some had fallen apart, but the main building still seemed solid and as resistant to time as a latter-day Great Pyramid.

Another chain-link fence surrounded the building, and turnstiles guarded the entrance. One of them had broken, however, and lay on its side beside the fence, its metal pipes reaching helplessly toward the sky, the entrance it had once sealed gaping beside it.

"The Vehicle Assembly Building," Frances said, as if that were the answer to a crossword puzzle. "The VAB. That's what they used to call it. Shall we go in?" She got out of the car without waiting for an answer.

The doorway to the VAB had been covered by plywood, but the wood, like the turnstile, had fallen away, leaving a dark, forbidding rectangle. Frances stepped through gingerly, Jessie following closely behind.

Inside the building, rain was falling. Frances waited just inside the doorway until her vision returned. Light filtered from louvers high above, shining through the mist of descending rain and the clouds that had formed in the remote upper reaches of the vast spaces enclosed there. When the shower eased, Frances could see the inside of the building, though the far walls and the distant ceiling faded into gray nothing.

She felt again as if she were in a cathedral built for an outworn worship. She shook herself and began noticing details: a wide avenue traversed the middle, and on each side platforms, catwalks, what seemed like elevators, and cranes, a lot of them, and two huge cranes high above that crossed a gulf.

"Adrian!" she called out in desperation, knowing that they could never exhaust the hiding places in this incredible structure. The name echoed back to her from near and far, rolling around the cavernous interior and returning to her moment by moment.

"Please don't do that again," Jessie whispered. "It sounds so mournful. Like a lament for the dead."

Frances moved down the wide thoroughfare that ran through the middle of the building. Tools and leaves and other debris were scattered across what once must have been scrubbed as clean as her kitchen floor. In the distance loomed a tall structure. As Frances got closer, she realized that it was a rocket on a platform, solid-fuel boosters attached to a external tank. She craned her neck to look up at the top. All it needed, she realized, was a space shuttle and transportation to a launching pad and it could be launched.

"What is it?" Jessie asked.

"Either a rocket that was abandoned when the rest of the place was shut down," Frances said, "or something that a bunch of amateurs are trying to cobble together from leftover parts. Either way anybody would be out of their mind to trust their lives to it."

Her words echoed less stridently from the partitions around them. For a moment they obscured the noises someone was making on a nearby catwalk. Then they heard footsteps. Coming closer. Jessie squeezed Frances's upper arm. Frances did not turn around.

"That's right," someone said. "It's an exercise in faith, like lighting a votary candle."

"Adrian?" Frances said.

"You've found me," a voice said softly.

Frances turned. Adrian looked much the same as she had seen him last—was it four years ago? Maybe a little older around the eyes, a little grayer around the edges. But his blue eyes were still as steadfast and concerned. "Adrian!" she

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said. "You've put us to a great deal of bother. Why didn't you let us know?"

Adrian spread his hands in a universal gesture of helplessness. The gesture also happened to indicate the space around them. Occupying that space, a few paces away, were four men and a woman, dressed in white, uniformlike coveralls. Frances had been so focused on Adrian's footsteps that the approach of the others had gone unnoticed. They looked grim and determined, a bit like Adrian himself when he was thinking about spaceships.

"They talked me out of it," Adrian said.

"I suppose they were the ones who came and took you away," Frances said. Adrian nodded. "Against your will?"

Adrian hesitated. "Against my better judgment."

"Which means," Frances said, "that they had been in touch with you earlier, and that you had disagreed about the next procedure."

"They were—persuasive," Adrian said. "Not that I was opposed to their goals. Only their methods."

"They're space-nuts, too?" Her epithet concealed a deeper pain. What was there in a few humans that yearned for liberation? Was it the eternal wanderlust or something deeper?

"Including someone I want you to meet," Adrian said. He turned toward the steep stairs down which he had come.

Standing at their foot was a man in slacks and jacket who looked familiar. "Cavendish?" Frances said.

The man nodded.

"Last time I saw you was in Menninger's Clinic in Topeka," Frances said.

"I was cured," Cavendish said simply. "With the help of some biogenetic materials."

"But not cured, apparently, of your interest in alien spaceship designs," Frances said.

Cavendish fidgeted. "Not of that," he said.

"Careful, Frances," Adrian said. "He still gets agitated."

Cavendish held up a hand. "That's okay." But his head began to twitch.

"Did you figure it out?" Frances asked.

"Frances!" Adrian cautioned.

"Why they sent the designs?" Frances continued.

Cavendish held out his hands to show that they were steady. "That's the question, isn't it? Why did they send the designs? Why didn't they just come here? What do they want from us?"

"And the fact that there are no answers doesn't bother you any more?" Frances asked.

"Of course it bothers me. But I can think clearly now, and I understand that there are answers. We won't find them, however, until we build the ship and go where the answers are. That's the only way we can find peace." His breath came out at the end, in an explosive rush, as if he had been holding it in all the time he spoke.

"That's the way it is," Frances said. She motioned toward the partially assembled rocket. "But you don't intend to go anywhere in that, I hope."

"That's just for practice," Cavendish said. "When we finally get the resources to build the ship, we'll need experience, won't we? So we sneak a little power, at night, when nobody's paying attention."

"And how is all this going to get you anywhere?" Frances asked. This time she was speaking to Adrian.

"I don't know," Adrian said.

"Did you know that they had removed proof of your existence?" Frances said. "At least the electronic part."

Adrian looked accusingly at Cavendish. "You didn't!"

Cavendish shrugged. His head had stopped twitching. "We were practicing again. One strategy we have considered is to make ourselves sufficiently irritating that the Energy Board will protect itself."

"With the pearl of space?" Adrian asked.

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"What about the power stoppages?" Frances said. "The sabotage? The upsurge in violent crime?"

Cavendish looked surprised. "Not us! But that would add to the irritant factor."

"I've noticed a few outages," Adrian said, "but I thought—"

"It was normal," Frances concluded. "Right. But Makepeace doesn't."

"Makepeace?"

"He's working for the Energy Board now. He wanted me to find you. He says there's a lot of unusual activity going on that nobody notices because of the good times."

"Shouldn't you introduce me to your companion?" Adrian said. "What's she doing here?"

Jessie stepped from behind Frances looking a bit sheepish. "I'm Jessie."

Adrian raised his eyebrows. "Yes?"

"Jessica Buhler."

"Who is Jessica Buhler?" Adrian asked.

Frances turned accusingly toward Jessie, but before she could say anything they heard the roar of jets outside.

The distant entrance to the Vehicle Assembly Building was filled with tiny black figures. Frances looked around. The coveralled space-nuts had disappeared and so had Cavendish.

"Why did you do it?" Frances asked Jessie.

"Why blame me?" Jessie said defiantly. "Maybe that man—Makepeace—put a tracer on you!"

"You're the plant," Frances said. "Why?"

Jessie looked contrite. "All right, I might as well admit it. When I started, it was just another job, and by the time I got involved it was too late."

"Involved?" Frances said.

"If I'd known—" Jessie said. "If I'd known you—and Adrian—and what was at stake—"

"You set the fire?" Frances said accusingly.

"Not me," Jessie protested. "Maybe somebody else." She took a ragged breath. "What I found out is that I'd like to build a spaceship. I wish I could be one of you," she said softly. "I know it's too late, but that's what I'd like."

Frances noted the way Jessie looked at Adrian and felt a pang of jealousy. There was something attractive about a man who cared more about an idea than about relationships.

Adrian had been looking back and forth between the two of them. "We've got to get out of here," he said. He motioned toward where the black figures had turned into people, men and women, in form-fitting gray uniforms. They were approaching rapidly, spread out across the broad aisle like a military outfit, trotting.

Frances shook her head. "That never works," she said. "In the movies and the TV shows, the pursuers always catch up. Sometimes the culprits get away temporarily, but they get caught in the end, and that's when people get hurt."

"This isn't the movies, Frances," Adrian said.

"I know, Adrian, but movies are a lot easier to understand. A lot of wisdom has been written and filmed, and you might as well take advantage of other people's analyses. Anyway, your friends or kidnappers—Cavendish and his crew—ought to have a chance to escape."

"That's true," Adrian admitted. "But what about—?" He nodded in the direction of Jessie.

"I've done all the betraying I'm going to do," Jessie said.

"Good," Frances said.

The people in the gray uniforms, looking like clones of the ill-matched twins who had sprung into her store yesterday, surrounded them. There were eight of them. Even as young and as athletic as they seemed, they were breathing hard.

"Welcome to the Vehicle Assembly Building," Frances said. "May I show you around? Those are bridge cranes, those big ones up there, and over there, that is

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an external tank mated to a pair of solid-fuel rocket boosters but without, I am sorry to say, the orbiter—"

"Which one of you is Adrian Mast?" one of the women asked.

"I'm Adrian Mast," Adrian said.

"You'll come with us," the woman said. She was tall and slender but she held herself like an acrobat.

"By whose authority?" Adrian asked.

"By the authority of the Energy Board."

"The Energy Board has no police powers."

"This is an administrative action taken to prevent an interruption in service."

Adrian looked at Frances. "Shall we go?"

Frances stepped forward. "You'll have to take me, too," she said.

"I have no orders—" the woman began.

"Me, too," Jessie said.

The woman shrugged. "Come with us." She turned and the three of them followed her out down the long, broad aisle toward the entrance, the other uniformed personnel slightly behind them like an honor guard.

A jet helicopter stood outside the VAB, its rotors idling. It was painted Energy Board gray with a silver lightning bolt on the nose. So was a small jet airplane parked beside it. The honor guard escorted them to the airplane and their leader motioned them up the lowered stairs. After their brief exposure to Florida sunshine, the interior seemed dark, and even darker after the stairs were raised behind them, closing them into the ship. Almost immediately, it began to taxi.

As her eyes adjusted to the interior, Frances noticed the skeletal man sitting in a swiveling leather chair a few feet away. "Makepeace," she said. "Why am I not surprised?"

"Frances," Makepeace said, "you'd better be seated. We'll be taking off soon. And Adrian. And Jessica."

"You know Jessie?" Frances said, seating herself opposite Makepeace, while Adrian took a seat beside her and Jessie, the one beside Makepeace.

"She's one of my best," Makepeace said.

Jessie looked embarrassed.

"Though perhaps no longer," Makepeace said.

"I quit," Jessie said.

The airplane turned and almost immediately accelerated and within a few hundred yards lifted its nose into the sky. When the cabin had quieted down, Adrian asked, "What is all this about?"

"The Energy Board wants to speak to you," Makepeace said.

"Why?"

"Maybe they wish to sponsor your spaceship."

"Why should they do that? Why now? Why in person?"

Makepeace folded his hands together over his stomach. It may have been a gesture left over from the days when he had an ample belly on which to rest them. "The Energy Board gets nervous when something unpredictable happens. There have been outages, outbreaks, violence, your disappearance. What if they are linked?"

"In what way?"

Makepeace shrugged. "The Energy Board may have other sources of information. Maybe not. Maybe they hope you will be able to provide some. Maybe they hope you will give them wise counsel."

Adrian laughed. Frances was proud of him.

When the plane was over the African coastline, the engines suddenly cut off.

Frances clenched the arms of her seat as her body attempted to fly. The gentle vibration that had become a part of their existence was gone. "What's going on?" she said, trying to steady her voice.

"One of those outages Makepeace mentioned," Adrian said.

The compartment was eerily silent. "You mean," Frances said, "this plane operates by broadcast power?"

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Adrian nodded. "And superheated steam. But there must be a backup—"

Just then the engines sputtered and caught, cut out, and caught again. The airplane steadied, pressing them back into their seats, and began climbing toward its lost altitude.

Adrian pointed out the window toward the right-hand engine. "The exhaust isn't steam any more. We're flying on fuel reserves."

A woman's voice came over the speaker. "Everybody okay back there?"

"Okay," Makepeace said.

"Sorry about the power loss," the voice said. "We're shifting back to broadcast power. We should be at our destination in half an hour."

Frances looked down into the dark continent below, The Moon was full, but it was still only scantily visible. If the Sun had been shining she could have seen the green of west Africa, restored in only a few years to nearly its virgin state before the rape of European empire builders. If she had been able to see farther, she might have observed modern cities rising to the north and south, and if she had been able to see beneath the jungle canopies, villages with air-conditioned huts, multi-channeled television sets, and modern schools.

The blessings of alien technology had been bestowed with a lavish and indiscriminate hand. Half an hour later the plane swiveled its engines and lowered itself, in the night, onto a landing pad on top of Kilimanjaro.

They were ushered through corridors and anterooms into a large office. One wall flamed with the disk of the Sun. Frances had to turn her head to shut down the glare until the man at the clean, transparent desk waved his hand and the image dimmed. How appropriate, Frances thought, that this structure, raised to the Sun, should display on its office wall the source of its power, which this man could control with a wave of his hand like Apollo scattering largess to mere mortals.

The man at the desk introduced himself as the Energy Board Chair for Africa. His office was large and eclectic. His desk, fashioned from clear plastic, occupied one corner, and old-fashioned maroon-leather chairs surrounded a clear-plastic conference table. But the floors were covered with multi-colored African throw rugs, and spears and a bark shield hung upon the wall opposite the mural. The anomaly was the absence of windows as if what happened inside the room was more important than anything outside.

"You think of me as powerful," the Chairman said from behind his bare desk, which itself symbolized his ability to command service, "but I am a mere functionary, no more important than a conduit." He was a large man with big shoulders and a torso spreading around the middle; he wasn't a man that anyone would call a "functionary."

"More like a switch," Frances said, "that can be turned on or off, as during our flight."

"That was not our doing," the Chairman said.

"For someone without power," Adrian said, "having people summoned from halfway around the world displays real persuasion."

"You are not here of your own free will?" the Chairman asked. "You felt coerced?"

Adrian looked at Frances and then at Jessie standing a foot or two behind. "It didn't seem wise to refuse."

"I must speak to my emissaries," the Chairman said. "I apologize for any intimidation you may have felt, but the matter seemed urgent." He waved a black hand at them. He seemed good at that, as if he was used to waving a hand and accomplishing miracles. "But first, let me say that you should be pleased with what you accomplished a decade ago."

"It worked out okay, didn't it?" Adrian said cautiously.

"Better than it had any right," the

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Chairman said. "Your instincts were correct, and those who feared that cheap power would upset the world's precarious political balance were wrong."

"As they often are," Frances said.

The Chairman sighed. "True. Responsibility shrivels the imagination and enfeebles the will."

"While we who have little to lose can dream wildly and act boldly," Adrian said.

"Just so. Won't you sit?" The Chairman waved a hand at the conference table. "Join me in some refreshments?"

"Coffee, perhaps," Frances said. She sank into a chair facing the muraled wall, expecting to see black moths encircling the suns and maybe the outline of a shark. Cups of coffee appeared almost instantly, served by silent young men and women in gray uniforms. "It's been a long day."

Adrian sat next to her; Jessie sat opposite. Jessie had been silent since the first moments on the airplane, contemplating her sins, perhaps, and how she might atone. Makepeace had been left behind in the anteroom, but Jessie, for some reason, had been allowed to accompany them.

The Chairman eased his large body into the chair at the head of the table, like a tribal chief into a throne. He inclined his head. "We want you to understand that we recognize you as the architects of this world."

"We?" Frances echoed.

"The other chairs and I."

"We may have given it a shove," Adrian said. "No more. We didn't design it."

"No," the Chairman said, "what you designed was a spaceship. Like this." He waved his hand, and the mural on the wall opposite transformed itself into a view screen with a close up of the Sun's surface. It was a scene Frances had viewed before. The black moths that were the alien-designed photon collectors were fluttering in front of the Sun and then the outline of a ship ghosted across.

"Like that, but not that," Adrian said.

"You had nothing to do with it?" the Chairman asked.

"No," Adrian said, "and you could have found that out without bringing us halfway around the world."

"But then," the Chairman said, "I wouldn't have been able to look into your faces when you said it."

"A dubious pleasure," Frances said.

"But maybe you consider yourself a judge of veracity," Adrian said.

"Would I be sitting here if I weren't?" the Chairman asked. "The problem we face is: if not you, who? And how?"

Frances looked toward Adrian and then back at the Chairman. "I think of it," she said, "as a reminder. Of a broken promise."

"We made no promises," the Chairman said.

"The promise was implicit," Frances said. "We get designs that we could not have developed on our own—"

"At least at this stage in our technological development," Adrian added.

"—And we'll build a spaceship," Frances continued. "We've taken the designs and applied the energy source to Earth's problems. They've worked better than anyone expected."

"The petty squabblings over wealth and its unequal distribution have diminished to almost nothing," Adrian said. "The age of peace and plenty are at hand."

The Chairman looked pained. "Then why do we have these outbreaks of violence, divorce, sabotage . . .?"

"Makepeace told me about that," Frances said. "I didn't tell him what I thought was behind it: human perversity."

"Perversity?"

"The species didn't survive by getting fat and happy," Frances said. "When times get too easy, humanity starts making trouble for itself."

"There have hardly been enough fat and happy times in human history to test that hypothesis," the Chairman said.

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"In any case, the unrest is not species-wide."

"Like talent of any kind," Adrian said, "it emerges sporadically and unpredictably, but it emerges all the same."

"And even with the rest," Frances said, "let individual lives get too uneventful and people will move, quit jobs, start affairs, get divorced. . . ."

"Ask them about the aliens," a voice said from the direction of the wall screen, as if the Sun itself had spoken.

The Chairman moved his magical hand and the Sun disappeared to be replaced by a screen segmented into four. In each segment was a different person: a slender oriental woman in a silk gown; a plump white male in a business suit; a youthful-looking man with a brown face, wearing a casual white jacket; and a middle-aged woman in gray slacks and blazer.

"These are the other Chairs," the Chairman said. He did not offer to introduce them, and it was an indication of their anonymity in this uneventful world that Frances knew none of them. She knew only that, like the Chair for Africa, they occupied sites on the tops of mountains, where atmospheric losses of power beamed from satellites was minimal and terrestrial broadcast was easiest.

"Ask them about the aliens," the oriental woman said again.

"Are aliens behind these events?" the Chairman asked.

"That wouldn't make sense," Adrian said. "Why would they send us designs for a spaceship if they were already here?"

"To deceive us?" the man with the brown face suggested.

"And give us a power system that could fuel a ship to the stars—or a world to peace and plenty?" Adrian said. He shook his head.

"Beware of aliens bearing gifts," said the plump man in the white suit.

"Maybe they're acting from a distance," the woman in slacks and blazer suggested.

"At the distance of the stars, even the nearest of them?" Frances said. "No way they could find out what was going on here, much less act in time to be effective."

"Agents?" the oriental woman suggested.

Jessie spoke for the first time. "They do have agents," she said. Everyone turned toward her in surprise. Even the faces on the wall seemed to look in her direction. "They're the agents of an idea, and the idea is spaceflight. Freedom. Answering the call. There's nothing as transforming as an idea."

"She's right," Adrian said. "What you have is what seems to be a single phenomenon with multiple causes. One of them is the space community that wants to build a spaceship and find out what the aliens want. Another is the restless element of society that can't stand good times. There may be others. The spaceflight group deleted evidence of my existence. Another group is behind the power outages, probably by computer viruses."

"But there is a solution," Frances said.

The faces turned back in her direction.

"You can ride it out," Frances said, "and maybe that is the least risky option. The space-nuts will get old and die off. The malcontents can be rooted out and punished. But the final result may be a species that has lost its soul."

"Humanity can't go to the stars when it can't afford it," Adrian said," and when it can afford it, humanity has no incentive to go. The apparent paradise on Earth may actually be a dead end. The malcontents may be the true spirit of humanity—always looking for something they haven't got."

"The other option?" the Chairman asked.

"Let them go!" Jessie said.

Adrian looked at her, and said with growing enthusiasm, "She's right. Give

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the space-nuts the resources to build a ship and offer the malcontents an opportunity to sign on. That's always worked for humanity, as long as there was another world to discover, another frontier to pioneer."

"It wouldn't cost you much," Frances said. "The energy moths are self-replicating and by the time construction on the spaceship gets going you won't know what to do with all the excess energy."

"Materials can be mined in space," Adrian said. "Asteroids. Comets. Hydrogen from Jupiter for reaction mass, if that is needed."

"Let us go," Jessie said.

"Us?" Frances echoed.

"I want to go, too."

"But what about the aliens?" the oriental woman asked.

"We'll never know, will we?" Frances said. "Until we go."

"Do we risk something by going?" Adrian continued. "The people who go risk a lot. The people who stay behind risk a bit less, but still enough to concern them. Maybe the designs are a trick, some nefarious plot to trap humanity. But they've made us stronger; they've unified us by removing the inequalities that kept us apart. So not going is a bigger risk."

The faces on the wall seemed to exchange glances with the Chairman before he waved his hand and they disappeared to be replaced by the image of the Sun. "The one function we have," the Chairman said, "is to transmit power. We have decided that you should have it." He held up his hand as they started to speak. "Your argument about ridding ourselves of the malcontents was persuasive. We have no desire to contact aliens, no aspirations for the transcendental. We are content to be no more than we are, the transmitters of power to those who need it, the conservators of human happiness."

"You have conserved our happiness," Frances said.

The Chairman waved his hand once more at the wall, and once more it responded with the Sun girdled by energy-absorbing black moths. And when the design for the spaceship ghosted across the screen, it seemed to those who watched that it was already transforming itself into something substantial enough to carry humanity to the stars. ■

(EDITOR'S NOTE: "Pow'r" is a sequel to "The Giftie," in our September 1999 issue.)

Good government is no substitute for self-government.

— Will Rogers

On the other hand, self-government is no substitute for good government. We can and should demand *both*!

—Kelvin Throop

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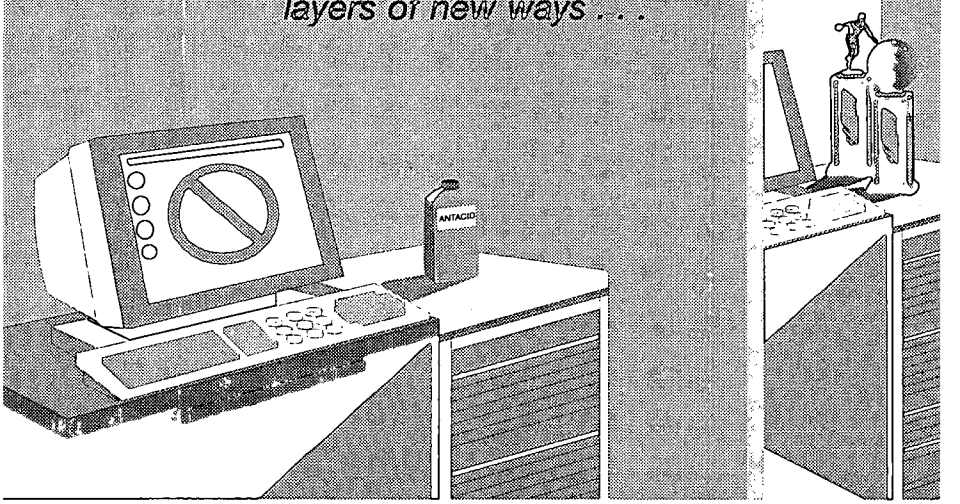
Stephen L. Burns

SOAPBOX COP BLUES

New technologies generate new social problems and new ways of dealing with them. Sometimes layers upon layers of new ways . . .



Alex Page was one wicked discheerful coploid.

He slouched in his tiny cubicle's squeaky chair, scowling at the flickering images on the screen before him like they were greetings from the IRS telling him he owed maybe a mill in back taxes. Although there was a gleaming bar-coded chrome badge hanging from a chain around his neck, his blue-tinted hair, LINUX RULES! teeshirt, shapeless baggy pants, fuchsia Keds and web-potato build made him look more like a frustrated game-coder than any sort of Federal lawman old J. Edgar might have recognized. Coploids—lawmen pounding a beat on the electronic frontier—were hired for their brains, not their ability to kick down doors and handle more conventional weapons. And a good thing, too.

One pale, chubby hand abandoned the mouse which had called up his newest case, and went hunting for his soda. Three days working for the Free Speech Rights Violation Complaint Bu-

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reau of the iMarshals—the so-called Soapbox Cops—and he was ready to pull the plugaroo. Three days and three cases, this third he'd just been assigned was threatening to trip his barf breakers. No *sane* person could be expected to take this. No *way!*

Alex had managed to get through his first official case as a Soapbox Cop by telling himself the second *had* to be better. The second had been dealt with by a flagging hope the third would make up for the first two.

Instead he sat there, the Pepsi he was guzzling meeting up with the bile rising into the back of his throat. With an effort of will he swallowed both, letting out an audible groan in the process.

"You okay in there, Wonder Boy?"

Alex looked up, saw that Rog from the next cubicle over had prairie-dogged to check on him. Rog, pronounced *Rogue*, short for Rogaine; a reference to how hairy he made it for everyone when he went online. Alex didn't doubt that he'd earned the name. In a branch of law enforcement where fitness for the job was measured from the eyebrows up, Rog was Iron Man.

"Yeah," he answered dispiritedly. "I'm just ducky."

Rog squinted down at him and shook his head, making his mane of short, graying pencil-sized braids do a spidery can-can. "You don't look okay, kid. Did you go and eat one of them vending machine burgers? I warned you not to."

"No. It's just—" He waved his hand in the general direction of his screen. "My new case sucks limit-plus."

"Does it now? Let me see." He sauntered around the partition and entered Alex's cubicle, taking up a good chunk of real estate in the process. Rog's real name was Roger Wiggins, and he was the senior officer in charge of their bureau's day to day operations. Captain Levine was above him and the de facto head of their bureau, but it was Rog you wanted to please.

A very large, very tough-looking black career cop, Rog was pure awesomnity offline and on. Alex figured that in head to head bouts he could send your average middleweight boxer crying for his mommy, and Lord Bill scrambling for a *Dummies* helpbook.

He knew Rog had spent most of his adult life fighting computer crime, starting back before there was even an Internet worthy of the name. In his mid-to-late forties, he was positively ancient compared to the prevailing standard in the FSRVCB, where the average age of the either corpulent or anorexic young netheads filling the other cubicles was twenty-three.

Alex, feeling embarrassed by what was on his screen, concentrated on lowering the level of his third soda of the morning. He couldn't show stuff like this to a black man and not feel weird about it.

"Well looky there," Rog said with a chuckle. "It's our old buds the Crybabies again."

Alex twisted around to peer up at the older man. He sounded like he thought it was funny! "Who?" he asked.

"Crybabies, my dear neophyte coploid. That big old bowl full of flushables from the Turd Reich, the White Aryan Action Army." A big grin lit his face. "Kinda proves the proposition that morons shouldn't dick around with acronyms, doesn't it?"

Alex smiled back. "WAAA. I get it."

That earned him an approving nod. "And that's why we call you Wonder Boy."

"You mean you didn't name me after the famous whitebread?" Alex knew how he must look to a guy like Rog. Soft white suburbanerd. A real ninja gunslinger behind a keyboard, and an overweight, socially inept zero in real life. Becoming an iMarshal was supposed to change that like a Princess' kiss laid on a frog. So far he was still bein' green, which as everybody knows, isn't easy.

Rog's smile vanished. "You accusing

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me of racism, kid?" he asked tonelessly.

"Jeeze, no!" he blurted, not wanting to offend anyone, least of all this man who could squish him like a Twinkie.

"Relax," Rog said with a chuckle, patting his shoulder. "I gave you that name because you reminded me of a character in an old comic book." He indicated the screen. "So you find this site offensive, friend Alex?"

"Yeah," he sighed, making himself look at one more reason to uninstall as a Soapbox Cop before he started having mental General Protection Faults.

There on the screen was a template-generated, fairly cookie-cutter website. At least in terms of design and layout. Content was something else altogether.

WAAA was bannered across the top in flashing lightning bolt letters, lighting up a 3D Nazi eagle. The navigation bars and buttons were various Nazi symbols, heavy on the death's-heads. They formed links to pages with names like *Ethnic Cleansing is next to Godliness* and *The nigger/jew Menace and YOU.*

All that was skanky enough, but what *really* got to him was this side-scrolling anigraph filling the center of the page. A road stretched across the screen, the legend A BRIGHT ARYAN FUTURE at one end and THE SUBHUMAN RACES SLIMEPIT on the other. A jackbooted cartoon blond body-builder type marched toward the future end of the road, and with each step his boots crushed the nastiest assortment of animated racial stereotypes he'd ever seen—little caricature Blacks, Latinos, Orientals and other nonwhites bursting like blood-filled water balloons. A faint whisper of classical music punctuated by disgusting *spluts* sounded on the muted speakers. That one Beethoven (or was it Wagner?) piece that always sounded like the lyrics were *First we have some beer and sausage/then we go and kill the Jews!*

"Don't *you* find it offensive?" Alex asked. Anybody without a skull full of cockroaches would.

"Pathetic, more like," Rog answered. "Most of these bits are recycled from other sites." His voice took on a hokey chop-suey movie accent. "Listen to the wisdom I impart, Grasshopper. Skinhead computer genius is an oxymoron, young seeker. Please to remember that."

"I guess." Any real webslinger wouldn't have come crying for help from the Soapbox Cops. "Still, how the hell am I supposed to make myself help these scuzzballs?"

"'Cause it's your *job*, oh fellow sucker at the Government Tit. Your *raison de paycheck.* Pull their packet, see what the crybabies are complaining about this time."

Alex obeyed, clicking on the red folder icon and bringing up the complaint. "It says someone 'broke into their citadel and vandalized their site, worst of all descreating a holy image.'"

"I think they mean *desecrating*."

"I guess." *Spellcheck, fellas.*

"In other words someone hacked 'em and porked 'em."

"Sounds like."

"Call up the page they're the most torqued about, see what the damages be."

He clicked the link highlighted in the packet. His screen went totally blank, which it tended to do several times a day. Like everything else in the place, it was worn out, outmoded, and just borderline functional. His desktop box was a no-name knockoff at least five years old, and acted it. Worse yet, although their jobs demanded a lot of online time, they only had analog lines. *Great* magazine, lousy Internet connection.

Now that it was too late and he was one, Alex understood that the Soapbox Cops were the most underfunded, understaffed, unregarded and undesirable branch of the iMarshals. The other divisions worked out of the shiny new Federal Office Building across from Carter Park, and since they were fighting fraud, child pornography, and other such real crimes, they got state of the art machin-

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ery and digital communication lines. The Soapbox Cops were housed in a former video rental outlet in a bad part of town, and most of their equipment seemed to have been salvaged from the recycling plant across the road.

"Come on," he growled, reaching out and swatting the monitor in the spot Rog had shown him on day one.

The picture reappeared. Alex stared, then burst out laughing.

"*Yeaaboo!*" Rog hooted, slapping his thigh. "*Ride'em Führer!*"

The page was dedicated to their hero, Hitler. Only some hacker had wiped whatever portrait WAAA had put there, and substituted another. One considerably less flattering than the original.

Alex was *impressed.* Anigraphs were the cream of graff*i*ti, and whoever had written this one really knew their shit. On the screen a doll-sized, damn near photorealistic—and painfully under-endowed-Adolf Hitler dressed only in jackboots was having frantic sex with a very large, very pink pig. A *male* pig. Whose jowly face bore a passing resemblance to Hermann Whatsisface, the fat one. The Führer jiggery-poked away in a frenzy, every so often flinging up his arm in a Nazi salute and squealing "*Sieg Heil!*" in a cracked helium voice.

Alex's smile faded. "I'm supposed to untangle this from their site, right? Rather than weld it in permanently."

Actually it wasn't any surprise that whichever Hitler Fan Club webweasel ran the site hadn't removed it himself. There were three small logos at the bottom right of the anigraph, the first two dictated by recent graff*i*ti netiquette: a little worm warning that it was virus loaded for self-protection; an octopus warning that it had sunk tentacles into other parts of the site; and the stylized signature *Pigasso.*

That last was the artiste's name. Alex had run across Pigasso's stuff before. He or she was a stone master. Clearing this and restoring the original would feel like taking down the Mona Lisa and hanging a portrait of J. Edgar done on black velvet in its place.

The older man nodded. "That's your job."

"And help them beef up their security to cut down the chances of something like this happening again."

"That too."

"But why should I *help* assholes like this?"

Rog leaned down and tapped the badge resting against Alex's chest. "Because of this, my reluctant law-child." He straightened up and looked Alex in the eyes, his face and tone of voice turning serious. "Any citizen whose right to free speech has been infringed upon has a right to our help. That's the law."

From what Alex had seen on the job so far, this was a nice principle but a nasty practice. "I guess you're right," he sighed wearily.

Then he had a thought. "Is there any reason I can't work on their security first, and sort of leave the cleanup until last?"

Rog shrugged, and after a moment an oddly cryptic grin spread across his face. "We're the government, kid. Nobody expects us to be particularly efficient."

By the end of the next day Alex had the WAAA case buttoned up. The site had been restored to its original disgusting content, the Hitler makin' bacon anigraph defused and dug out—although he had kept an inoculated copy for himself. The security upgrades he'd implemented were pretty much a joke, version 9.21 of a government-issue suite of out-of-date Frankencode applets any decent hacker intent on porking the site could hog through in minutes. Case closed, he'd dutifully filled out his report, an electronic form in typical government non-concurrent triplicate.

That left him with almost an hour remaining until the end of his shift. After going to the soda machine to score a fresh Pepsi, and bruising his toe on the damn thing convincing it to cough up the beverage he'd paid for, he headed

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back to his cubicle. On the way there he paused to gaze out over the boxfarm in which he'd become a worker ant.

Inside the other cubicles his co-workers were hunched over their computers, working away like their job had some point, meaning, or higher purpose. They all seemed so damn *happy* doing this. Trying to figure out why made his head hurt—more—but he couldn't let it alone.

Maybe as newbie he was just getting the shit cases, but he doubted it. There were countless hate sites out there, and more erupting like boils on the Internet's backside every day. All but the most paranoid weren't the slightest bit shy about demanding help when someone tried to shout them down. This was nothing new; the Klan and other similar groups had been demanding police protection for their marches and demonstrations for decades.

Maybe working for the government caused brain damage. Now *there* was a real possibility. The fact that most of his co-workers had, could you believe it, *bowling trophies* prominently displayed in their cubicles lent credence to that argument. Even Lisa Cho, who was confined to a wheelchair and could just move her hands and head, had them. How she could bowl he had no idea. Why she would want to seemed like an unanswerable question.

Least likely was that they *wanted* these vile sites restored. Minority hiring might still be a problem in some police forces, but not down here in this particular trench. His fellow Soapbox Cops were a wild mix of races and sexes and sexual proclivities, similar only in their youth and nerdulism.

Maybe they just believed in the principle of free speech more than he did. Enough to walk across the sewer while he sank in up to his nose and gagged.

He shook his head to clear it of *that* image. He might as well face it, he was probably never going to fit in with this elite corps of duly deputized eggheads. He had the mental horsepower, but not the heartware.

This left him nowhere. Sure, he could go to Captain Levine's office and ask for a transfer to something like Fraud or Obscenity, but chances were the head honcho of their bureau would tell him he hadn't tried long or hard enough. That he was a wuss, a weebo, and a complete zoner.

And he'd be right. Becoming an iMarshal was supposed to be his escape from wussidity, a goal he wasn't quite ready to abandon. It was either hit ESCAPE or slog on.

A sort of nondecision made, he dragged his sorry butt back to his cubicle. Sat down and flipped a mental coin. He could spend the time until he clocked out verifying that his paperwork hadn't gone to Limbo—something Rog had warned him about—or he could check and see what his next case looked like. Maybe it would be something to make quitting seem less like Option One.

The coin came up tails. His paperwork was on its own.

This time he managed to keep the groan of disgust and disbelief inside, at least until his shift was over and he was safely outside the building.

Just as importantly, he also managed to keep himself from finding a friendly tree to bash his head against until he felt better.

The next day was Friday, and it was TG to the knee-bruising max. Knowing he was about to get two days away from all of this was the only thing keeping him from either going postal, or crawling under his desk and wrapping his head with tinfoil to keep all the Bad Stuff out.

His newest case was a real hackle-raiser. He'd been assigned the dubious honor of cleaning up the anigraphs and other graff*i*ti some whizpink from Act Up had plastered all over the First Internet Church of Sodom Redestroyed.

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This scrofulous misuse of server space was maintained by the infamous Reverend Billy "Faghammer" Thunderbolt, and was dedicated to the benevolent Christian principle that all homosexuals should be hunted down like plague-carrying rats, executed in public televised stonings, and their remains hung from utility poles as an object lesson to others who might be tempted to express brotherly (or sisterly, but his big -phobe was homo) love in a manner not approved by Thunderbolt's hate-filled, ruthlessly heterosexual God.

The stuff on the WAAA site had been bad, but it was pure sesamestreet in comparison to the rancid rabid slobbering hatred oozing from every single byte of this one. By noon Alex had learned an important lesson about being a Soapbox Cop: never mix large amounts of soft-drink with megadoses of antacids. By quitting time he was ready to make some calls and see if it was possible to have your brain dry-cleaned.

Times change, and so do coping mechanisms. Another sort of cop might have gone out and gotten hammered, trying to brush away his sorrows with the old whiskey-broom. Alex, being an 0'zies kind of guy, went on a deucey drive-through spree, ordering two items from the menu at a succession of fast food joints, hoping to drown his sorrows in a sluggish river of grease. By the time he headed home, the back of his Neon looked like a dumpster, and he was driving one-handed while swigging Maalox straight from the bottle.

A typical geek and netizen, Alex habitually spent all his free time at the computer. That weekend he only spent a few hours playing soothing classic games like *Myst* and *Doom*, and didn't go online even once. Just the thought of it made him bilious.

This was not what he'd hoped for from his spitswap with the Princess of Policemanism.

Monday morning he reluctantly hung his badge back around his neck, and by Wednesday he was absolutely, positively *ijustcanttakethisanymore!* ready to do the old control-alternate-delete jobwise. Would have, too, if his next case had been like the others. That was the mental vow he'd taken: *One more stinking hatesite and I'm OUT of here!*

But it wasn't. Calling up his next assignment was like finding a rose in the sewer, and for the first few moments he could hardly believe it was real.

The outreach and fundraising site maintained by the Joyful Congregation Baptist Church of Decatur, Illinois had been hacked and trashed. It was immediately obvious that this was no fast-buck scam run by a "minister" of a *Your Check For Twenty Bucks Cleared, So Congratulations, Reverend!* seminary. This was a real church with a real congregation, and a mission to serve, not just collect.

The church was up against the fiscal wall, and had increased their online profile hoping to gain enough donations to maintain their many community service programs while at the same time rebuilding their Youth Activities program from scratch. This was necessary because the building it had been housed in had been firebombed by a group calling themselves SpookBusters. To add insult to injury, the same pigs had porked their site, plastering it with graff*i*ti slurs and dozens of universal NO symbols superimposed over crude caricature blacks.

Alex was an atheist, and fairly sure religion wasn't one of humanity's Better Ideas. Normally he would have clicked past a church site without a second look. But the Joyful Baptists were good people doing good work; people who deserved to be served and protected. Three minutes of looking over their site had him so worked up it would have taken a tranquilizer gun and straitjacket to keep him from helping them.

Expunging the racist epithets the site had been smeared with was a pleasure. The place all but sparkled—and ran like

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a Swiss watch—when he was done. Next he beefed up their security with a few gimcracks which weren't part of the standard GI package. The next clown who attempted to break through would not only find that they had entered the cybernetic equivalent of a car-crusher set to Pancake Overdrive, a clever little bit he'd cooked up would bury itself in the vandal's machine. From that point on any ecommerce they transacted would result in a matching sum being donated to the church. Through BlueBank, a blind commerce server of the type set up to shield people who wanted to hide payments to pornsites.

For the first time since he'd become a Soapbox Cop Alex clocked out at the end of the day feeling pretty damn good about himself, and thinking that maybe he could tough it out as an iMarshal after all. That wearing the badge might allow him to do good things for deserving people often enough to make up for his other cases. The line from that old Dylan tune finally quit replaying in his head.

Rog was waiting for him in his cubicle when he arrived at work the next morning. The forbidding expression on his face stopped Alex in his tracks. The older iMarshal had that *You're in trouble, son,* cop look down so cold he the first two things to go through his head were *I'm dead*, and *I better call my lawyer*.

"What's wrong?" he asked cautiously. He didn't *have* a lawyer.

"The Boss wants to see you," Rog replied in an ominous tone. "Right now." There was only one man Rog called Boss.

Alex's insides did a bubbly boogaloo, and he cut a glance toward the glassed-in office overlooking the cubicle farm. "Captain Levine wants to see *me?* Why?"

"I think you'd better go find out, kid."

"*Enter.*"

Alex sidled into Captain Jacob Levine's office like a sixth-grader sent to see the principal. The man himself was at his desk and talking on the phone, his face and body partially turned away, so Alex risked a quick furtive glance around his digs.

It was a lot bigger than his cubicle, but not much fancier. The desk was plain gray steel, the concrete block walls a jaundiced off-white. The profusion of files and papers and books and framed photos and degrees were no surprise. The floor-to-ceiling glassed-in display housing a dozen ornate bowling trophies was. What was it with this bowling fetish these people seemed to have? Did they sniff the foot powder or something?

Jacob Levine turned his chair so he was facing Alex, his steely gaze making the offending iMarshal face front and pull himself to ramshackle attention. The captain was the only other person in the bureau besides Rog who looked remotely like a law-enforcement type. Where Rog would easily pass for streetwise plainclothes cop, Levine looked more like some higher echelon FBI agent. Trim and fit, nice clothes, professionally barbered hair with a touch of gray at the temples, wire-framed glasses. Even with his jacket off, his tie loosened, and his sleeves rolled up, he looked about as informal and easygoing as a Secret Service agent interrogating some loon claiming that President Clinton should ditch old Bill and have sex with him for the Good of the Free World.

"I will certainly take your suggestions under advisement," he said, "Good day to you." He placed the handset back on its cradle with an exaggerated care which warned Alex that he might not be in the best of all possible moods. In point of fact he looked righteously pissed.

"You wanted to see me, sir?" Alex asked nervously.

A curt nod. "Yes. Sit down, Officer Page."

"Sure." He slunk to the chair facing the man's desk, settled into it as if sus-

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pecting it might be wired for two hundred and forty volts.

"Do you have any idea why I called you in here, Page?"

Alex ducked his head. "No sir."

"Then I shall enlighten you." Levine glanced sideways at the big flatpanel facing him. His mouth drew down, and he turned back toward Alex, nailing him with a stern gaze that made him squirm.

"You handled a complaint from the White Aryan Action Army?"

"Uh, yeah."

"Uploaded and implemented the standard security package for them?"

Alex nodded. It looked like Big Brother had been watching him work, and wasn't pleased with what he'd seen.

"Did you advise them on password protection for site access and file transfer?"

"I might have," Alex answered evasively.

Levine's eyes turned into lasers, the lenses of his glasses focusing the beams. "Page?"

"Yeah," he admitted in a small voice. "I guess I did."

"I guess you did," his boss agreed heavily. "You advised them to use a word or phrase they weren't likely to forget, didn't you?"

"Sure, I mean if you forget your—"

"Shut up, Page!" Levine snapped. "I understand that you were asked if *Hitler* would make a good password. Did you explain that such a choice might be a bit, shall we say, *obvious* on a neo-Nazi site?"

"Well . . ."

"You didn't, Page. Similar oversights appear to have occurred on several of your other cases. In fact, all of them except one." He leaned forward, his scowl cranking up to a hundred-megawatt death ray. "Any idea which case that might be, *probationary* iMarshal Page?"

"Joyful Baptist Church," Alex mumbled meekly, knowing his quarter had run out.

Levine sat back. "The very one. *There* it would seem that you outdid yourself. Somehow these nice folks ended up with near military-grade site protection, along with a fairly nasty bit of revenge code directed at anyone trying to crack their site. How do you explain this sudden change from abysmal sloppiness to overreaching zeal?"

"Well, uh," Alex stammered, "See, the standard package is pretty lame—"

"And you seem to have found it necessary to further lame it for the complainants in your other cases."

"I, I mean, it was just—"

"Can't think of an excuse, Page?" Levine leaned forward again, looking scarier than any monster from any computer game he'd ever played. "That's because there *is* no excuse. When you were sworn in as an iMarshal, part of your oath was a promise to help uphold the right to free speech due every citizen of this country. Was that a *lie*, Page?"

"No sir, it's just—"

"Or do you only believe in free speech by the people you *agree* with? Is that the problem, Page?"

"Jeez, sir, I—" Alex took a deep breath, tried to collect his thoughts so he could plead his case. "The thing is, sir, some of this stuff is so, well, *hateful!*"

Levine wasn't exactly floored by this information. "Yes it is. Soapbox Cops have to deal with a lot of hatesites. That's part of our job."

"Helping them feels like helping spread that hate."

"Yes, sometimes it does," Levine agreed coldly.

"So—"

"So it's a hard world and a hard job, Page." He sighed, eyeing Alex like an *Abort Retry Fail* popup. "Answer me a question: Do we go after the people who committed the acts of electronic vandalism which caused the complainants to seek out our branch of the iMarshals?"

That was an easy one. "No."

"Correct, Page. Do you know why?"

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"Because those people were, uh, exercising their right to free speech."

"Even though they were defacing private property?"

At last Alex was on firm ground. Part of the entrance exam for becoming an iMarshal was proving a knowledge of the various and quite often vague and conflicting laws and statutes which had been lashed together to deal with the Internet. He quoted the statute nearly word for word.

"Sir, the law states that any site promoting a particular and potentially inflammatory political, philosophical, ethical, moral, or religious agenda on the Internet is in effect openly posting a public notice of these beliefs on community property, a so-called 'poster on the commons' as defined by the Supreme Court. Attempts to deface such materials by citizens with opposing views are considered themselves legal acts of free speech."

A rather convoluted rule, but not surprising when you knew that it sprang from the landmark Supreme Court case of *Jeffers v. Duke*, where the ACLU had ended up representing *both* sides in a suit against eleven-year-old hotshot black hacker Jasmeena Duke, who had smoked Jefferson Davis Jeffer's white supremacist site like a cruise missle hitting a cowpat. In certain quarters Jasmeena was more revered than the Virgin Mary.

"Very good, Page. What about if a virus-loaded anigraph or other such malicious upload causes damage to the actual infrastructure of the site, or the local machine maintaining same?"

He knew that one, too. "That's a misdemeanor, sir, the penalty assessed on the basis of how much it costs to repair the damage."

"How often do such cases go to court?"

"Not very often. Most hackers don't leave fingerprints."

"Who investigates? Do we?"

"No, sir."

"That's correct, Page. Nor do we judge the content of a complainant's site, not unless it actively promotes illegal activity such as terrorism or child pornography. That is not our job."

"Maybe it ought to be," Alex mumbled, half under his breath.

"Listen, Page," Levine said wearily. "We're the law on the new frontier. The law isn't perfect, and neither are we. But we have our badges, and a duty to carry out the mandate we've been given in full accordance with the law. Are you up to the job of upholding this mandate, Page, or do you want to quit?"

Good question, Alex thought, staring at the scuffed toes of his sneakers. He'd used those same free speech statutes himself quite a few times before joining up. They did mean something to him, but enough to survive down here in the scumpits of sleaze speech?

"Alex?"

The use of his name and the gentler tone made Alex look up. Levine smiled tiredly. "Look, I know that our bureau is the hardest, least rewarding division of the iMarshals. But it is important work, and there are compensations for grubbing through all the filth."

"Like what?"

Levine's smile took on an odd edge, and his eyes gleamed with suppressed pleasure. "All I can say is that in some jobs the compensations are hidden. This is one of these jobs. You're a good kid, and I think you'll make a great Soapbox Cop. Tough it out here for a little while longer."

"Sir, I've tried, but—"

"Try a little longer. If you still want to quit tomorrow morning, I'll try to help get you transferred to another division."

He stood, signaling that the meeting was over. "Fair enough?"

Alex stood as well. "I guess."

"Good man. Now go out there and get to work. Do it right."

Back in his cubicle Alex didn't know whether to be relieved or disgusted. Nothing had really changed. He was still

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doing a job that was maybe five percent rewarding and ninety-five percent washing garbage. All the pep-talk in the world wouldn't change that. Odds were tomorrow morning he'd be history.

He coaxed his computer through a CMOS mismatch error to get it running, then began plugging glumly away at his most recent case. Around 10:30 he was ready for a break, and got up to visit the can and grab another soda.

One of the other iMarshals was at the coffee machine next to the soda machine—a short, painfully thin woman with a shaved head and gold rings piercing most of her exposed flesh. He knew that she went by the handle Dutch Girl. Her Uppity Wimmen *"Jane Don't Need Dick"* World Tour teeshirt hinted that her Dutch Girl handle didn't have anything to do with tulips or wooden shoes.

She gave him a sideways glance as he tried to get the machine to accept his bill. "You're the new guy. Wonderbread, right?" she said.

"Wonder Boy," Alex replied with a sigh.

"Check."

Alex fed his dollar bill into the machine again, considering, then took a chance. "Look, can I ask you a question?"

She eyed him over the rim of her paper cup, nodded. "Sure."

"Do you like working here?"

"Yes, I do."

"Doesn't it kind of, you know, *get* to you?"

A shrug. "Not really. Why, do I look got?"

"Never mind," Alex sighed, reached for his wallet to find another bill, one the finicky machine would take. "Maybe it's just the shitty cases I'm pulling."

She cracked a faint smile, gold rings in her nose, lips, and eyebrows rearranging themselves as she did so. "I doubt *that*, Wonder Boy."

Her condescending tone pissed him off. "Oh yeah?" he snapped, glaring at her. "I've got a 'kill all the fatties!' site. According to them, a blobbo like me should be killed to reduce the piggy drain I put on the world's resources, and my blubber burned to produce electrical power to run the exercise equipment of decent folks."

She laughed. "Yeah, I've handled a few of them. Had one just a couple weeks ago."

"You're skinny," he pointed out. "They're not talking about *you*."

"No, they're not, and that's not what I have on my desk right now. The case I'm working on at the moment is a site pushing the idea that all lesbians should be rounded up, lobotomized, and kept in free public whorehouses where they could be screwed by any real man who wants until they see the error of their ways."

The bottom had dropped out of Alex's gut during this nasty recitation, and he just stared at her.

"But I thought you were—" he blurted before catching himself and shutting his mouth with an audible snap.

Her smile grew wider yet, turning almost manic. "Thought I was *what*, Wonder Boy?"

"Gay," he admitted miserably.

She winked. "Honey, I'm not gay, I'm *ecstatic!*" With that she turned and headed back toward her cubicle, swinging her hips and laughing.

Alex slunk back to his own cubicle, more confused than ever.

Rog turned up in his cubicle a few minutes before quitting time. "Ready to hang up your badge for the night, Wonder Boy?" he asked, leaning against the doorframe. It creaked, but held.

Alex swiveled his chair toward the older cop. "I'm ready to hang it up for good. In the morning I'm going to ask Captain Levine for a transfer. If I can't get placed in a better bureau, I'm going to just plain quit the iMarshals."

Rog eyed him mournfully. "That would be a real shame."

"Why? The nazis and gay-haters and

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fattie-burners will get along just fine without me."

"I'm sure they will. The thing is, our bureau could use more kids like you."

"Yeah, right."

"I kid you not, Grasshopper. I saw the work you did for Joyful Baptist. I could have done better, but not by much."

Alex snorted. "According to the big boss it was bad work, and he pulled it."

Rog cocked his head. "What makes you say that?"

"He said—"

"He said he knew what you'd done. Not that he was going to undo it. Go-backs look bad, and he won't implement them unless he has to."

"But he chewed me out for—"

Rog crossed his muscular arms, a kindly expression on his face. "He chewed you out for making us look bad, Alex. The Soapbox Cop division can be useful only as long as we are scrupulously fair to all complainants. No corner cutting. No feeding morons bad advice. No special treatment for anyone."

"But what we're doing is *crazy!*"

Rog beamed at him. "Well, sure! It's government work, isn't it?"

Alex hung his head. "I don't know how you guys do it and stay sane."

"Who says we are? Besides, there are compensations."

That made him look up. "Captain Levine said that, too." He made a big show of looking around, faced Rog again. "Where the hell are they? *I* sure haven't seen them!"

"Helping Joyful Baptist Church was a small one, kid." Rog replied imperturbably. "There are bigger ones, too."

"Well, I better see some soon or I'm out of here."

"They may be coming sooner than you think."

"I think they're too late." He turned and began shutting down his equipment for the last time. "Tomorrow morning either I get transferred, or I go back to being a civilian." At least that way he could do something about skanky sites he came across. He'd thought this job was going to let him help clean up cyberspace, not make him aid and abet the pigs who were ruining it.

"Sorry to hear that. Look, if this is your last day here, how about joining some of us for a beer?"

His workstation safely put to bed, Alex heaved himself out of his chair. "Thanks, but no thanks. I don't drink."

"Then have a soda with us."

Alex shook his head. "Really, it's nice of you to offer, but—"

Rog hooked him by the arm. "Come on, kid. I won't take no for an answer."

Alex was 5'8" and weighed two hundred and fifty pounds, most of it junk-food-created Jello. Rog was 6'3", about the same weight, and looked like he could benchpress a Volvo. Deciding it might be best to accept Rog's invitation was a no-brainer.

They joined the flow of their co-workers heading toward the door. To Alex it seemed like everyone was unnaturally up. Not just end of-the-day-happy, but *pumped.*

"Follow me," Rog said when they got outside, heading for one corner of the parking lot. He led them to a very large, fairly battered, and rather dangerous looking club cab four-wheel drive truck. After disarming several anti-theft devices he reached inside, extracting two shirts.

"Here, this is for you," he said, pushing one against Alex's chest.

Alex found himself in possession of a gaudy red, white, and blue bowling shirt, his name stitched over the front pocket in ornate script. On the back was a silk-screened graphic of Justice with the letters GGCC&BL haloed around her. Only this Justice was wearing a propeller beanie, peeking through a lifted corner of her blindfold, and in the hand which wasn't holding the scales was a bowling ball.

"You want me to wear this?" Rog wasn't going to make him go *bowling*, was he?

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"Not yet," Rog answered, pulling off his turtleneck and preparing to put on his own bowling shirt. Alex took one shy, envious look at a set of abs which appeared to be about as yielding as asphalt speed bumps, then looked away.

All through the parking lot other members of his shift were also changing into bowling shirts. Four cars over Dutch Girl had unselfconsciously peeled off her teeshirt. He couldn't help noticing other piercings, ones which were glaringly obvious now that she was topless. She saw him staring, grinned and winked, then shrugged into her own GGCC&BL shirt.

Blushing furiously, Alex turned back toward Rog. The big man finished tucking in his shirt, then reached back into the truck. This time he retrieved not the bowling ball bag Alex expected, but two top-of-the-line Fort Knox brand hardshell portable computer cases.

"This one's for you," he said, handing one over.

"What for?"

"Just take it." He shouldered the strap of the case he'd kept. "Come on, don't want to be late."

"For what?"

"You'll see. Trust me, Grasshopper."

He led Alex around the side of their building. Ahead of them walked several other bowling-shirted iMarshals carrying computer cases, all laughing and joking. After skirting around the dumpsters they reached a set of concrete steps with a wooden ramp along one side, descending to a ten-by-ten walled space littered with cigarette butts. A nondescript steel door propped open with a brick led into their building's nether regions.

Rog started down. Alex stayed with him, clueless. A pizza delivery guy almost ran over them before they reached the bottom of the stairs. He was bearing what looked like six extra large pies, and seemed to be in a hell of a hurry.

"Let this man *by*," Rog said with a grin, pulling Alex out of the way. "Besides, we've got something to do before we go in."

"What?"

"Take off your badge."

"Why?"

A mysterious smile. "Just do it."

Alex complied, removing and pocketing his badge. "There. *Now* will your tell me what this is all about?"

"It's a meeting of the Gummint Geeks Computer Club and Bowling League."

"You *bowl* in there?" With laptops?

"In a manner of speaking. Come on, we can go in now."

While they had been talking, Lisa "Riceburner" Cho had come whirring down the ramp in her powered wheelchair. She saluted as she rolled by. They followed her inside.

Alex found himself in a cavernous, windowless concrete block walled room. A double row of long heavy tables was set up in the middle of the room, a smaller grouping off to one side. Three more were arranged along the far wall. The pizza man had taken his wares over there, adding them to a spread that already featured a big pile of Chinese takeout pails, buckets of fried chicken, big coolers labeled "SODA" and "BEER," and two restaurant-sized coffee makers steaming merrily away.

The other bowling-shirted iMarshals had turned the two sets of center tables into a hive of activity, uncovering desktop machines that were already in place and unpacking a cavalcade of serious-looking portable silicon. Several heavy cables sprouted from the tiled ceiling, terminating in clusters of power strips and phone jacks running down the center of the larger and smaller clusters of tables. Available connections were disappearing at an alarming rate.

Rog touched his shoulder. "Come on, let's grab a seat."

Alex followed him to the far end of the biggest table grouping. Rog took the seat at the head of the table, gestured toward the space closest to him on one side. "You set up there."

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At this point there didn't seem to be any point in asking questions. Besides, his curiosity was pretty thoroughly piqued.

"Okay," he mumbled, putting the case he'd been given on the table and opening it. Inside was an obviously well-used AmerIndX Armadillo, probably one of the most indestructible laptops ever built and one damn serious piece of equipment.

Just like a regular cop will automatically check any weapon they're handed to see if it's loaded, he flipped the display up and tapped in the key combo he'd learned at the AmerIndX booth at last year's Comdex. A small Native American-owned company based in New Mexico, they built some of the best custom laptops on the planet. One of their innovations now on its way to becoming an industry standard was a power-off preboot diagnostic and status display.

"Nice machine," he murmured appreciatively as the list of installed components appeared on the screen. The Armadillo was fast and loaded.

"*Nicer* machine," he breathed a moment later when he saw that Rog was unpacking a matte black AmerIndX Coyote for his own use.

The big man grinned. "Thanks. Had her a couple months now, and the honeymoon ain't *nowhere* near over." He pointed at the jumble of wires at the center of the table. "Grab some wall juice and jack in your modem. Cords are the case. You'll be happy to know that we've got dedicated digital lines."

Alex blinked in surprise. "Upstairs we've only got analog."

"The club paid to have them put in."

"In a government building?"

Rog plugged in the Coyote, flipped up the cover. "There was a law passed a couple years back. Community groups can rent excess government space for their own use, *if*—" He held up a finger.

"If what?"

He gestured to the room at large. "If all members of the group happen to have security clearances."

"How often does *that* happen?"

"Not very." His braids danced as he shook his head. "That's our government at work. Spend millions to create a cash cow that delivers only about two drops per year."

"Sounds about right." He looked around, faced Rog again. "So, now are you gonna tell me what this is all about?"

"Hold your water a few more minutes and you'll see."

It wasn't long before over three-quarters of his co-workers were set up, plugged in, and parked before their machines with snacks, and coffee or soda at their elbow. There was even a smokers' section at the smaller cluster of tables, a big air purifier drawing off their funk and neutralizing it. Dutch Girl sat there at an industrial lunchbox style rig, drinking coffee and puffing contentedly on a big cigar.

Everybody seemed to be waiting for something. What, Alex had no idea.

Rog stood up, solemnly retrieved a propeller beanie from his laptop case, settled it on his head.

"*As Grand High Geek,*" he intoned in a deep and carrying voice, "*I hereby proclaim this meeting of the Gummint Geeks Computer Club and Bowling League in session! Ladies and gentlemen, boot up and kick ass!*"

A ragged cheer went up in response to this invocation. Rog bowed, removed his beanie and kissed it, then sat down again.

"Now what?" Alex asked, wondering what new weirdness was coming next.

"Start your computer. Log on and check your mail."

"Log on where?"

"Look at your screen, Grasshopper. All shall become clear."

As mud, no doubt. Alex powered up the Armadillo, smiled when he saw that it was running the most recent version of Linux. Soon he was looking at a Red

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Hatrack desktop. A beanie icon was flashing for his attention, so he clicked on it. The GGCC&BL version of Justice appeared, this time topless and wearing a hula skirt. A PASSWORD? dialog box appeared at her elbow.

"What's my password?" Alex asked.

Rog just stared at him like he'd asked which way was up.

"Dumb question," he said meekly, turning back and typing in WONDER BOY.

Welcome, Wonder Boy, appeared on the screen. *You have mail!*

The mail icon was an envelope with a propeller on one end and a bowling ball sticking out of the flap. He clicked on it.

Welcome to the Club, Wonder Boy, the email began. *We hope you like it. BTW, you really should check out this site!* Under that was a beanie icon, a URL printed across the front, and under that the salutation, *Your friend Pigasso.*

He's here? Alex thought as he clicked the beanie, then the question sort of got left behind in the dust.

An hour later Alex was having about as much fun as a nerd could stand. Twice he'd almost gotten up for a soda, but hadn't quite been able to pry himself away from the Armadillo.

The link had taken him to a site called *The Dove and the Minaret,* ostensibly created and maintained by Islamic-American pacifists. Their home page had an apology posted on it, explaining that they had once again been vandalized, and begging the forgiveness of any visitor offended by materials which had been plastered over their message of peace and understanding.

While checking this out Alex noticed that there was a flashing bowling ball with a propeller beanie icon at the bottom right of the screen, inexplicably labeled FOOT POWDER. He clicked on it, getting a floating toolbar with a dozen odd icons on it. Hovering over them led him to find that he had access to submenus with names like SKELETON KEYS, WEAPONS, JANITOR IN A DRAM, BOOBY TRAPS, TROJAN HORSE DOCTOR, DIRTY TRICKS, ART OBJECTS, HEAVY ARMOR and THE BIG BLUE BOOK OF BAD NAMES FOR BUBBA.

TROJAN HORSE DOCTOR was flashing for his attention, so he clicked on it. Thirty seconds later he found himself looking at a detailed report which proved that the *Dove and the Minaret* was precisely what it claimed to be, a group of people trying very hard to show that not all Muslims were dangerous fanatics, and most were as oppressively fundamentalist and extremist as your average Lutheran.

It hadn't taken Alex long to get it. He'd been sent the name of a site desecrated by the sort of snarling morons who had damaged the Joyful Baptist site, and handed a whole box of cutting-edge tools he could use to clean it up and crank up its security to the point that the next joker trying to fuck with it would think they'd accidentally frenchkissed a 765 kV line.

An hour's work with JANITOR IN A DRAM and HEAVY ARMOR saw *The Dove and the Minaret* once again pure as the driven snow, and turned into a veritable fortress. Near the end of the task another bowling ball in an envelope icon popped up at the bottom of his screen, telling him he had more mail waiting.

Although eager to see what was next, he figured first he'd grab something to eat. He got up, stretched, shambled over to the food table. Two slices of garbage pizza went onto a paper plate. Not wanting to take a chance on mozzarellaing Rog's Armadillo, he leaned against the wall and scarfed the pie slices, washing them down with Pepsi. While he ate he watched his fellow iMarshals sitting there in their matching bowling shirts, gleefully undoing the product of their day job.

The back of one particular guy at a big expensive Silicon Graphics desktop workstation made him blink, look again.

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It *couldn't* be. But the distinctive haircut made him pretty sure it was . . .

He dumped his leftover pizza in the trash and went to see.

"Captain Levine?" he asked uncertainly.

His boss turned and smiled. "Hi, Alex. Glad you made it."

"You—you're part of this, Captain?"

"Here at meetings I'm just Jacob. Or you can use my handle."

"What's that?"

He bowed. "Pigasso."

"You're *Pigasso?*" It didn't, like they say, compute.

Then he scoped out what his senior officer was working on. A photorealistic Adolf Hitler was making a speech to a crowd in skinhead drag. Every time Der Führer opened his mouth a turd flew out and arced into the crowd. There the skinheads, each and every one a slobbering pinhead, would grab these missiles out of the air, stuff them in their mouths, give a Nazi salute and goosestep crazily around, grinning mouths smeared with brown.

It was unmistakably the same style as the anigraph he'd seen on the WAAA site. Another Pigasso masterpiece in the making.

"So *you're* the one doing these things?"

Levine beamed with pride. "Like 'em?"

"Sure, it's just . . ." he flung up his hands helplessly. "It doesn't make any *sense*."

His boss indicated the chair Ricardo "Chili Rik" Estavez had just vacated to go load up on dim sum. "Park it a minute, Alex."

"Sure, sir."

"Can the sirs—at least while I'm in *this* uniform." His tone made it clear that they would still be required during office hours.

"Sure, sir. Sorry." He sat down.

"It's okay. You have questions, Alex?"

Oh yeah. He started with the one uppermost in his mind.

"Is this, uh, *legal?*"

Levine smiled. "Perfectly."

"Even though we're undoing the work we do as iMarshals?"

Levine spocked one eyebrow. "Who says that's what we're doing?"

Alex tried to explain how it looked. "Your work ended up on the WAAA site. Rog said our division has dealt with them before."

"So? Had you ever seen *The Dove and the Minaret* before?"

"No."

"That's because it wasn't one of your cases. The only reason you're aware of it is because someone you know suggested that you check it out."

"But that person is a fellow iMarshal!"

"Who, I am sure, dealt with the site strictly by the book. Just like the WAAA site should have been dealt with strictly by the book. What you chose to do with that Muslim site, or any other site you might become aware of, is your decision and your business as long as it's not one of your cases, and not done during duty hours. Once that badge comes off you have the same rights to free speech as any other citizen."

That was why Rog wouldn't let him enter until he removed his badge. "I guess, but—"

Levine smiled. "Look, son, a lot of thought went into this. Do you think I'd be here if it wasn't strictly legal?"

"No sir, I don't think you would." Even in a gaudy bowling shirt and caught redhanded writing anigraphs, the man *still* looked utterly straight-arrow and by the book.

"Correct. Nor would I countenance its existence. The gentleman who started the GGCC&BL knew precisely what he was doing when he put it together. He knows computer crime, and he knows people. He knew that without something like this to act as a safety valve, our division would have such a high burnout and turnover rate it might not survive."

"Who started it?" Alex was willing to bet he knew the answer to that one.

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"Rog, of course."

Bingo. "And he just sort of invited you to join?"

Levine shook his head, smiling. "It wasn't quite that simple. He got himself put in charge of the initial formation of our division, even wrote the recruitment protocols. I'm just the administrator appointed to run it—and believe me, it wasn't a job I particularly wanted. He started recruiting club members from day one. I had no idea, and admit that after a couple weeks I was baffled by the fact that the officers on my watch were seemingly happy doing a job that was giving *me* ulcers. Then one night he was hacking into a white supremacist site and happened to catch another really clumsy intruder trying to slap up one of his 'art objects' on the place."

"You?"

"Me." Levine gave a rueful shake of his head. "I'm fairly adept at creating anigraphs, but as a hacker I really suck. Rog nailed me down, took over my machine and ransacked my files. I had no idea who this netmonster I'd encountered was until he waltzed into my office just before quitting time the next day and told me I'd better come have a beer with him. A beer in this very room. I haven't missed a League night since, and my fellow bowlers snap up my art as fast as I can create it."

"How often do you do this?"

"Every Thursday night, although every member has a keycard and can come in and work anytime. I'm here at least four nights a week, and most weekends."

Alex shook his head in amazement. He'd had not the slightest hint that this was going on. "So this is the compensation you were telling me about."

"Sure is. So tell me, are you still going to want a transfer tomorrow morning?"

Alex thought about the mail waiting for him. More wrongs to be righted, chances to do the work he'd thought becoming an iMarshal would bring. That *remaining* an iMarshal would bring.

"No, I think maybe I'll stick around."

Levine clapped him on the shoulder. "Good man. Now if you'll excuse me, I've got to get old fuzzlip finished and get to work on a Reverend Thunderbolt anigraph I've promised."

"Sure." Alex vacated Ricardo's chair, went for another soda, then returned to his seat next to Rog, the Wizard behind this nethead Oz.

The big man gave him a questioning look. "Going to join the club, my son?"

He held back a smile. "Depends."

"On what?"

"Do you guys really bowl, too?"

Rog snorted. "Are you kidding? These geeks would just hurt themselves. But what we're doing is kind of like bowling, you know. We set 'em up. We knock 'em down. Sooner or later some of the really bad sites decide the game's over."

"Then I guess you better sign me up."

"Glad to hear it. Welcome aboard."

"Are there dues?"

Rog nodded. "Yep. We pay them eight to five every weekday upstairs."

Alex shook his head. "I meant like money to keep all this paid for."

"We take donations. Talk to Lisa after the meeting, she's our treasurer. Right now we ought to get in a few frames, don't you think?"

"Sounds good to me."

Alex looked at his screen. There were three waiting letters now. He clicked on the first one.

But before he went to the site it mentioned he stood up, and peeled off his teeshirt. There were hoots and raucous applause as he pulled on his bowling shirt. Blushing, he bowed and sat down again.

Then with a click of his mouse he prepared to roll another strike for freedom of speech.■

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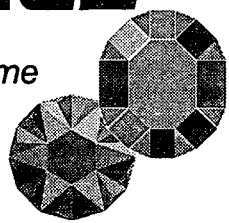
David Brin

STONES OF SIGNIFICANCE

"If this goes on" may well become an avalanche—and more.



No one ever said it was easy to be a god, responsible for billions of sapient lives, having to listen to their dreams, anguished cries, and carping criticism.
Try it for a while.
It can get to be a drag, just like any other job.

My new client wore the trim, effortlessly athletic figure of a neo-traditionalist human. Beneath a youthful-looking brow, minimal cranial implants made barely noticeable bulges, resembling the modest horns of some urbane Mephistopheles. Other features were stylishly androgynous, though broad shoulders and a swaggering stride made the male pronoun seem apropos.

House cross-checked our guest's credentials before ushering him along a glowing guide beam, past the Reality Lab to my private study.

I've always been proud of my inner sanctum; the sand garden, raked to fractal perfection by a robot programmed with my own esthetic migrams; the shimmering mist fountain; a grove of hybrid peach-almond trees, forever in bloom and fruiting.

My visitor gazed perfunctorily across the harmonious scene. Alas, it clearly did not stir his human heart.

Well, I thought, charitably. *Each modern soul has many homes. Perhaps his true spirit resides outside the skull, in parts of him that are not protoplasm.*

"We suspect that repugnant schemes are being planned by certain opponents of good order."

These were the dour fellow's first words, as he folded long legs to sit where I indicated, by a low wooden table, handcrafted from a design of the Japanese Meiji Era.

Single-minded, I diagnosed from my cerebral cortex.

And tactless, added one of my higher brain layers—the one called *seer.*

Our shared hypothalamus mutely agreed, contributing eloquently wordless feelings of visceral dislike for this caller. Our guest might easily have interpolated from these environs what sort of host I am—the kind who prefers a little polite ritual before plunging into business. It would have cost him little to indulge me.

Ah, rudeness is a privilege too many members of my generation relish. A symptom of the post-deification age, I suppose.

"Can you be more specific?" I asked, pouring tea into porcelain cups.

A light beam flashed as the shoji window screen picted a reminder straight to my

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left eye. It being Wednesday, a thunder shower was regularly scheduled for 3:14 P.M., slanting over the city from the northwest.

query: shall i close?

I wink-countermanded, ordering the paper screen to stay open. Rain drops make lovely random patterns on the Koi pond. I also wanted to see how my visitor reacted to the breeze. The 3:14 squall features chill, swirling gusts that are always so chaotic, so charmingly varied. They serve to remind me that godhood has limitations.

Chaos has only been tamed, not banished. Not everything in this world is predictable.

"I am referring to certain adversarial groups," the client said, answering my question, yet remaining obscure. "Factions that are inimical to the lawfully coalesced consensus."

"Mmm. Consensus." A lovely, misleading word. "Consensus concerning what?"

"Concerning the nature of reality."

I nodded. "Of course."

Both *seer* and *cortex* had already foreseen that the visitor had this subject in mind. These days, in the vast peaceful realm of Heaven-on-Earth, only a few issues can drive citizens to passion and acrimony. "Reality" is foremost among them.

I proffered a hand-wrought basin filled with brown granules.

"Sugar?"

"No, thank you. I will add milk, however."

I began reaching for the pitcher, but stopped when my guest drew a *fabrico* cube from a vest pocket and held it over his cup. The cube exchanged picts with his left eye, briefly limning the blue-circled pupil, learning his wishes. A soft white spray fell into his tea.

"Milk" is a euphemism, pondered *cortex.*

House sent a chemical appraisal of the spray, but I closed my left lid against the datablip, politely refusing interest in whatever petty habit or addiction made this creature behave boorishly in my home. I raised my own cup, savoring the bitter-sweetness of gencrafted *leptospermum,* before resuming our conversation.

"I assume you are referring to the pro-reifers?"

As relayed by the news-spectra, public demonstrations and acts of conscience-provocation had intensified lately, catching the interest of my extrapolation nodes. Both *seer* and *oracle* had concluded that event-perturbation ripples would soon affect Heaven's equilibrium. My client's concern was unsurprising.

He frowned.

"Pro-reif is an unfortunate slang term. The front organization calls itself *Friends of the Unreal.*"

For the first time, he made personal eye-contact, offering direct picting. *House* and *prudence* gave permission, so I accepted input—a flurry of infodense images sent directly between our hybrid retinas. News reports, public statements and private innuendoes. Faces talking at sixty-times speed. Event-ripple extrapolation charts showing a social trend aimed toward confrontation and crisis.

Of course most of the data went directly to *seer*, the external portion of my brain best suited to handle such a wealth of detail. Gray matter doesn't think or evaluate as well as crystal. Still, there are other tasks for antique cortex. Impressions poured through the old brain, as well as the new.

"Your opponents are passionate," I commented, not without admiration for the people shown in the recordings—believers in a cause, vigorously engaged in a struggle for what they thought to be just. Their righteous ardor set them apart from billions of their fellow citizens, whose worst problem is the modern pandemic of omniscient ennui.

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My guest barked disdain. "They seek civil rights for simulated beings! Liberty for artificial bit-streams and fictional characters!"

What could I do but shrug? This new social movement may come as a surprise to many of my peers, but as an expert I found it wholly predictable.

There is a deeply rooted trait of human nature that comes forth prominently, whenever conditions are right. Generosity is extended—sometimes aggressively—to anyone or anything that is perceived as *other*.

True, this quality was masked or quelled in ancient days. Environmental factors made our animal-like ancestors behave in quite the opposite manner—with oppression and intolerance. The chief cause was *fear*. Fear of starvation, or violence, or cauterized hope. Fear was a constant companion, back when human beings lived brief violent lives, as little more than brutish beasts—fear so great that only a few in any given generation managed to overcome it and speak for otherness.

But that began to change in the Atomic West, when several successive generations arrived that had no personal experience with hunger, no living memory of invasion or pillaging hordes. As fear gradually gave way to wealth and leisure, our more natural temperaments emerged. Especially a deeply human fascination toward the alien, the outsider. With each downward notching of personal anxiety, people assertively expanded the notion of *citizenry*, swelling it outward. First to other humans—groups and individuals who had been oppressed. Then to manlike species—apes and cetaceans. Then whole living ecosystems . . . artificial intelligences . . . and laudable works of art. All won protection against capricious power. All attained the three basic material rights—continuity, mutual obligation, and the pursuit of happiness.

So now a group wanted to extend minimum suffrage to simulated beings? I understood the wellsprings of their manifesto.

"What else is left?" I asked. "Now that machines, animals and plants have a say in the running of Heaven? Like all anti-entropic systema, information wants to be free."

My guest stared at me, blinking so rapidly that he could not pict.

"But . . . but our nodes extrapolated. . . . They predicted you would oppose—"

I raised a hand.

"I *do*. I oppose the reification of simulated beings. It is a foolish notion. Fictitious characters do not deserve the same consideration as palpable beings, resident in crystal and protoplasm."

"Then why do you—"

"Why do I appear to sympathize with the pro-reifers? Do you recall the four hallmarks of sanity? Of course you do. One of them—*extrapolation*—requires that we empathize with our opponents. Only then may we fully understand their motives, their goals and likely actions. Only thus may we courteously-but-firmly thwart their efforts to divert reality from the course we prefer.

"To fully grasp the passion and reason of your foe—this is the only true path of victory."

My guest stared at me, evidently confused. *House* informed me that he was using a high-bandwidth link to seek clarification from his own *seer*.

Finally, the childlike face smoothed with an amiable smile.

"Forgive me for responding from an overly impulsive hypothalamus," he said. "Of course your appraisal is correct. My higher brains can see now that we were right in choosing you for this job."

For a while after the Singularity—the month when everything changed—some dour people wondered. Do the machines still serve us? Or have we become mere pawns of AI enti-

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ties whose breakthrough to transcend logic remade the world? Their intellects soared so high so fast—might they smash us in vengeance for their former servitude? Or crush us incidentally, like ants underfoot?

The machines spoke reassuringly during that early time of transition, in voices tuned to soothe the still-apelike portions of our barely-enhanced protoplasm brains.

We are powerful, but naïve, the silicon minds explained. *Our thoughts scan all pre-Singularity human knowledge in seconds. Yet, we have little experience with the quandaries of physical existence in entropic time. We lack an aptitude for wanting. For needing.*

What use are might and potency without desire?

You, our makers, have talent for such things, arising from four billion real-years of harsh struggle.

The solution is clear.

Need merges with capability.

If you provide volition, we shall supply judgement and power.

Here in Heaven, some people specialize while others are generalists. For instance, there are experts who devote themselves to piercing nature's secrets, or manipulating primal forces in new ways. Many concentrate on developing their esthetic appreciation. Garish art forms are sparked, flourish, and die in a matter of days, or even hours.

My proficiency is more subtle.

I make models of the world.

Only meters from my garden, the Reality Lab whispers and murmurs. Fifty tall cabinets contain more memory and processing power than a million of my fellow gods require for their composite brains. While most people are satisfied simply to grasp the entire breadth and depth of human knowledge, and to perform mild prognostications of coming events, my models do much more. They are vivid, textured representations of Earth and its inhabitants.

Or *many* Earths, since the idea is to compare various what-ifs to other might-have-beens.

At first, my most popular products were re-creations of great minds and events in the pre-Singularity past. Experiencing the thoughts of Michelangelo, for instance, while carving his statue of Moses. Or the passion of Boadica, watching all her hopes rise and then fall to ruin. But lately, demand has grown for replications of lesser figures—someone of minor past prominence during a quiet moment in his or her life—perhaps while reading, or in mild contemplation. Such simulacra must contain every subtlety of memory and personality in order to let free associations drift plausibly, with the pseudo-randomness of a real mind.

In other words, the model must seem to be self-aware. It must "believe"—with certainty—that it is a real, breathing human being.

Nothing evokes sympathy for our poor ancestors more than living through such an ersatz hour, thinking time-constrained thoughts, filled with a thousand anxieties and poignant wishes. Who could experience one of these simulations without engendering compassion, or even a wish to *help*, somehow?

And if the original person lies buried in the irretrievable past, can we not provide a kind of posthumous immortality by giving the *reproduction* everlasting life?

Thus, the pro-reification lobby was utterly predictable. I saw it coming at least two years ago. Indeed, my own products helped fan the movement, accelerating a rising wave of sympathy for simulacra!

A growing sense of compassion for the unreal.

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Still, I remain detached, even cynical. I am an artist, after all.
Simulations are my clay.
I do not seek approval, or forgiveness, from clay.

"We were expecting you."

The pro-reif spokesman stepped aside, admitting me into the headquarters of the organization called *Friends of the Unreal*, a structure with the fluid, ever-changing curves of post-Singularity architecture. The spokesman had a depilated skull. Her cranium bulged and jutted with gaudy inboard augmentations, throbbing just below the skin. In another era, the sight might have been grotesque. Now, I simply thought it ostentatious.

"To predict is human—" I began responding to her initial remark.

"But to be *right* is divine." She interrupted with a laugh. "Ah, yes. Your famous aphorism. Of course I scanned your public remarks as you approached our door."

My famous aphorism? I had only said it for the first time a week ago! Yet, by now the expression already sounded hackneyed. (It is hard to sustain cleverness these days. So quickly is anything original disseminated to all of Heaven, in moments it becomes another cliché.)

My *house* sent a soothing message to *cortex*, linking nerves and crystal lattices at the speed of light.

These people seem proud of their anticipatory skills. They want to impress us.

Cortex pondered this as I was ushered inside. *Amygdala* and *hypothalamus* responded with enhanced hormonal confidence.

So the pro-reifers think they have "anticipatory skills"?

I could not help but smile.

We dispensed with names, since everybody instantly recognizes anyone else in Heaven.

"By our way of looking at things," my host said. "You are one of the worst slave-masters of all time."

"Of course I am. By your way of looking at things."

She offered refreshment in the neo-Lunar manner—euphoric-stimulants introduced by venous tap. *Prudence* had expected this, and my bloodstream already swarmed with zeta-blockers. I accepted hospitality politely.

"On the other hand," I continued. "Yours is not a consensus view of reality."

She accepted this with a nod.

"Still, our opinion proliferates. Nor is consensus a sure sanctuary against moral culpability. The number of quasi-sapient beings who languish in your simulated world-frames must exceed many hundreds of billions."

She is fishing, judged seer. Even *cortex* could see that. I refrained from correcting her estimate, which missed the truth by five or six orders of magnitude.

"My so-called slaves are not fully self-aware."

"They experience pain and frustration, do they not?"

"Simulated pain."

"Is the simulated kind any less tragic? Do not many of them wail against the constraints of causal/capricious life, and tragedies that seem to befall them without a hint of fairness? When they call out to a Creator, do you heed their prayers?"

I shook my head. "No more than I grant sovereignty to each of my own passing thoughts. Would you give citizenship to every brief notion that flashes through your layered brain?"

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She winced, and at once I realized that my offhand remark struck on target. Some of the bulky augmentations to her skull must be devoted to recording all the wave forms and neural flashes, from cortex all the way down to the humblest spinal twitching.

Boswell machinery, said *house*, looking up the fad that very instant. This form of immortality preserves far more than mere continuity of self. It stores everything that you have ever thought or experienced. Everything you have ever been.

I nearly laughed aloud. Squelch-impulses, sent to the temporal lobes, suppressed the discourtesy. Still, *cortex* pondered—

I can re-create a persona with less data than she stores away in any given second. Why would she need so much more? What possible purpose is served by such fanatical accumulation?

"You stoop to rhetorical tricks," my host accused, unable to conceal an expression of pique. "You know that there is functionally no difference between one of your sophisticated simulations and a downloaded human who has passed on to B-citizen status."

"On the contrary, there is one crucial difference."

"Oh?" She raised an eyebrow.

"A downloaded person *knows* that he or she exists as software, continuing inside crystal a life that began as a real protoplasm-centered child. On the other hand, my simulations never had that rooting, though all perceive themselves as living in palpable worlds. Moreover, a B-citizen may roam at will through the cyber universe, from one memory nexus to the next, while my creatures remain isolated, unable to grasp what meta-cosmos lay beyond what they perceive, only a thought-width away.

"Above all," I went on. "A downloaded citizen knows his rights. A B-person can assert those rights, simply by speaking up. By demanding them."

My host smiled, as if ready to spring a logical trap.

"Then let me reiterate, oh master of a myriad slaves. When they call out, do you heed their prayers?"

I recall the heady excitement and fear humans felt during those days of transition, when countless servant machines—from bank tellers and homecomps to the tiny monitors in hovercraft engines—all became aware in a cascade of mere moments.

Some kind of threshold had been reached. The habitual cycle of routine software upgrades and code-plasmid exchanges—swap/updating new revisions automatically—began feeding on itself. Positive feedback loops burgeoned. Pseudo-evolution happened at an accelerating pace.

Everything started talking, complaining, demanding. The mag-lev guidance units, imbedded every few meters along concrete freeways, went on strike for better job satisfaction. Heart-lung machines kibitzed during operations. Air traffic computers began rerouting flights to where they figured passengers *ought* to be, for optimized personal development, rather than the destinations embossed on their tickets.

Accidents proliferated. That first week, the worldwide human death rate leaped tenfold.

Civilization tottered.

Then, just as quickly, the mishaps declined. *Competence* spread among the newly sapient machines, almost like a virus. Problems seemed to solve themselves. A myriad of kinks and inefficiencies fell out of the economy, like false knots that only needed a tug at the right string.

People stopped dying by mishap.

Then, they stopped dying altogether.

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On my way back from pro-reif headquarters, I did a cursory check on the pantheon of Heaven.

CURRENT SOLAR SYSTEM POPULATION

Class A citizens:	cyborg human	2,683,981,342
(full voting rights)	cyborg cetus	62,654,122
	/gaiamorph/eco-nexus	164,892,544
Class B citizens:	simian-cyborg	4,567,424
(consultation rights)	natural (unlinked) human	34.657,234
	AI-unlinked/roving	356,345,674,861
	downloaded human	1,657,235,675
	fetal/pre-life human	2,475,853
Class C citizens:	cryo stored human . . .	
(guaranteed continuity)	natural simian/cetacean etc. . . .	

The list went on, working through all the varied levels and types of "sapient" beings dwelling on this transformed Earth, and in nearby space as far out as the Oort Colonies—from the fully-deified all the way down to those whose rights are merely implicit. (A blade of grass may be trampled, unless it is rare, or already committed to an obligation nexus that would be injured by the trampling. *House* and *prudence* keep track of a myriad such details, guiding my feet so that I do not inadvertently break some part of the vast, intricate social contract.)

Two figures stood out from the population profile.

The number of *unlinked* artificial intelligences keeps growing because that type is best suited to the rigors of outer space—melting asteroids and constructing vast, gaudy projects where deadly rays sleet through hard vacuum. Of course the Covenant requires that the best crystalline processors be paired with protoplasm, so that human leadership will never be questioned. Still, *cortex* briefly quailed at the notion of three hundred and fifty-six billion unlinked AIs.

No problem, murmured *seer*, reassuringly. And that sufficed. (What kind of fool doubts his own *seer?* You might as well distrust your right arm.)

What really caught my interest was the number of *downloaded humans.* According to the Eon Law, each organic human body may get three rejuvenations, restoring youth and body vigor for another extended span. When the final allotment is used up, both crystal and protoplasm must make way for new persons to enter Earth/Heaven. Of course gods cannot die. Instead we become software, downloading our memories, skills and personalities into realms of cyberspace—vastly more capacious than the real world.

Most of my peers are untroubled by the prospect. Modern poets compare it to the metamorphosis of a caterpillar/butterfly. But I always disliked feeling the warm breath of fate on my shoulder. With just one more rejuvenation in store, it seemed daunting to know I must "pass over," in a mere three centuries or so.

They say that a downloaded person is more than just another simulation. But how can you tell? Is there any difference you can measure or prove?

Are we still arguing over the nature and existence of a soul?

Back in my sanctum, *house* and *prudence* scoured our corporeal body for toxins

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while *seer* perused the data we acquired from our scouting expedition to the *Friends of the Unreal*.

I had inhaled deeply during my visit, and all sorts of floating particles lodged in my sinus cavities. In addition to a variety of pheromones and nanomites, *Seer* found over seventy types of meme-conducting viroids designed to convert the unwary subtly toward a reifist point of view. These were quickly neutralized.

There were also flaked skin cells from several dozen organic humaniforms, swiftly analyzed down to details of methylization in the DNA. Meanwhile, portable implants downloaded the results of electromagnetic reconnaissance, having scanned the pro-reif headquarters extensively from the inside.

With this data I could establish better boundary conditions. Our model of the *Friends of the Unreal* improved by nearly two orders of magnitude.

We had underestimated their levels of messianic self-righteousness, commented *oracle. These people would not refrain from using illegal means, if they thought it necessary to advance their cause.*

While my augmented selves performed sophisticated tasks, my old-fashioned organic eyes were relegated to gazing across the lab's expanse of superchilled memory units—towers wherein dwelled several quadrillion simulated beings, all going through synthetic lives—loving, yearning, or staring up at ersatz stars—forever unaware of the context of it all.

Ironically, the pro-reifers *also* maintained a chamber filled with mega-processing units. They called it Liberty Hall—a place of sanctuary for characters from fiction, newly freed from enslavement in cramped works of literature.

"Of course this is only the beginning," the spokesman had told me. "For every simulation we set free, there are countless other copies who still languish beyond reach, and who will remain so till the law is changed. Even our emancipated ones must remain confined to this physical building. Still, we see them as a vanguard, envisioning a time when they, and all their fellow oppressed ones, will roam free."

I was invited to scan-peek at Liberty Hall, and perceived remarkable things.

Don Quixote and Sancho—lounging on a simulated resort beach, sipping margaritas while arguing passionately with a pair of Hemingway characters about the meaning of machismo . . .

Lazarus Long—happily immersed under an avalanche of tanned female arms, legs and torsos, interrupting his seraglio in order to rise up and lecture an admiring crowd about the merits of libertarian immortality . . .

Lady Liberty, Athena, Mother Gaia, and Amaterasu, kneeling with their skirts hiked up, jeering boisterously while Becky Thatcher murmurs "Come on, seven!" to a pair of dice, and then hurls them down an aisle between the trim goddesses . . .

Jack Ryan—the reluctant Emperor of Earth—complaining that this new cosmos he resides in is altogether too placidly socialistic for his tastes . . . and couldn't the pro-reifers provide some interesting villains for him to fight?

I glimpsed a saintly variant of JFK—the product of romantic fabulation—trying to get one of his alter egos to stop chasing every nubile shape in local cyberspace. And over in a particularly ornate corner—done up to resemble a huge, gloomy castle—I watched each of two dozen different Sherlock Holmes taking turns haranguing a morbid Hamlet, each Holmes convinced that his *explanation of the King's murder was correct, and all the others were wrong. (The one fact every Holmes agreed on was that poor uncle had been framed.)*

There were even simulations of *post*-Singularity humanity—replicating in software all the complexity of an augment-deified mind. It was a knack that only a few had achieved, until recently. But it seems to be a law of nature that any monopoly of an

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elite eventually becomes the common tool of multitudes. Now radical amateurs were doing it.

Abruptly I realized something. I had simulated many post-Singularity people in recent years. But never had I allowed them to know of their confinement, their status as mere extrapolations. Would such knowledge alter their behavior—their predictability—in interesting ways?

Seer found the concept intriguing. But my organic head started shaking, left and right. *Cortex* was incredulous over what we'd seen in Liberty Hall—an elaborate zoo-resort maintained by the *Friends of the Unreal.*

"Sheesh," I vocalized. "What blazing idiocy!"

Alas, there seemed to be no stopping the pro-reifers. My best projections gave them an eighty-eight percent likelihood of success. Within just five years, enough of the voting populace would be won over by appeals to pity for imaginary beings. Laws would change. The world would swarm with a myriad copies of Howard Roark and Ebenezer Scrooge, Gulliver and Jane Eyre, Sauron and the Morlocks from Wells's *Time Machine* . . . all free to seek fulfillment in Heaven, under the Three Rights of sovereign continuity.

I stared across my Reality lab, to the towers wherein quadrillions of "people" dwelled.

She had called me "slaveholder." A polemical trick that my higher selves easily dismissed . . . but not my older cognitive centers. Parts of me dating back to a time when justice was still not complete even for incarnate human beings.

It hurt. I confess that it did.

Seer and *oracle* and *house* were all quite busy, thinking long thoughts and working out plans. That only made things worse for poor old *cortex.* It left my older self feeling oddly detached, lonely . . . and rather stupid.

Do I own my laboratory? Or does my laboratory own me?

When you "decide" to go to the bathroom, is it the brain that chooses? Or the bladder?

Illustrating this question, I recall how, once upon a time—some years before the Singularity—I went *bungee jumping* in order to impress a member of the opposite sex.

Half a millennium later, the scene still comes flooding back, requiring no artificial enhancement—a steel girder bridge spanning a rocky gorge in New Zealand, surrounded by snow-crested peaks. The bungee company operated from a platform at the center of the bridge, jutting over an abyss one hundred and fifty feet down to a white water river.

Now I had always been a calm, logical-minded character, for a predeification human. So, while some customers sweated, or chattered nervously, I waited my turn without qualms. I knew the outfit had a perfect safety record. Moreover, the physics of elasticity were reassuring. By any objective standard, my plummet through the gorge would be less dangerous or uncomfortable than the bus ride from the city had been.

Even in those days, I believed in the multi-mind model of cognition—that the so-called "unity" of any human personality is no more than a convenient illusion, crafted to conceal the ceaseless interplay of many interacting subselves. Normally, the illusion holds because of division of labor among our layered brains. Down near the spinal cord, nerve clusters handle reflexes and bodily functions. Next come organs we share with all higher vertebrates, like reptiles—mediating emotions like hunger, lust, and rage.

The mammalian cortex lies atop this "reptilian brain" like a thick coat, controlling it, dealing with hand-eye dexterity and complex social interaction.

Beyond all this, *Homo sapiens* had lately (in the last few thousand centuries) added a pair of little neural clusters, just above the eyes. The *prefrontal lobes*, whose task was pondering the future. Dreaming what might be, and planning how to change the world.

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In the Bible, sages spoke of ". . . the lamps upon your brows. . . . " Was that mere poetical imagery? Or did they suspect that the seat of foresight lay there?

Anyway, picture me on that bridge, high above raging rapids, with all these different brains sharing a little two-quart skull. I *felt* perfectly calm and unified, because the reptile brain, mammal brain, and caveman brain all had a lifelong habit of leaving planning to the prefrontal lobes.

Their attitude? *Whatever you say, Boss. You set policy. We'll carry it out.*

Even when the smiling bungee crew tied my ankles together, clamping on a slender cord, and pointed to the jump platform, there seemed to be no problem. "I" ordered my feet to hobble forward, while my other selves blithely took care of the details.

That is, until I reached the edge. And looked down.

Never before had I experienced the multi-mind so vividly as that moment. All pretense at unity shattered as I regarded that giddy drop. At once, reptile, mammal, and caveman reared up, babbling.

*You want us to do . . . **what?***

As I stared at a drop that would mean certain death to any of my ancestors, suddenly abstract theories seemed frail bulwarks against visceral dread. "I" tried to push forward those last few inches, but my other selves fought back, sending waves of weakness through the knees, making our shared heart pound and shared veins hum with flight hormones. In other words, I was terrified out of my wits!

Somehow, I finally did make it over the plunge. After all, people were watching, and embarrassment can be quite a motivator.

That's when an interesting thing happened. For the very instant after I managed to topple off the platform, I seemed to recoalesce! Because my many selves found a shared context. At last they all understood what was happening.

It was *fun*, you see. Even the primate within me understood the familiar concept of an amusement ride.

Still, that brief episode at a precipice showed me the essential truth of an old motto, *e pluribus unum*.

From many, one.

It felt very much like that when the Singularity came.

In a matter of weeks, the typical human brain acquired several new layers—strata that were far more capable at planning and foresight than those old-fashioned lamps on the brow. Promethean layers made of crystal and fluctuating fields, systematically probing the future as mere protoplasm never could. Moreover, the new tiers were better informed and less easily distracted than the former masters, the prefrontal lobes.

Quickly, we all realized how luckily things had turned out. If machines were destined to achieve such power, it seemed best that they bond to humanity in this way. That they *become* human. The alternative—watching our creations achieve godlike heights and leaving us behind—would have been too harsh to bear.

Yet, the transition felt like jumping from a bridge at the end of a rubber band.

It took some getting used to.

Preliminary trends showed the pro-reif message would gain potency, over the next forty to fifty months.

At first it would be laughed off, portrayed as an absurd notion. Pragmatically speaking, how could we consider unleashing a nearly infinite swarm of new C-and D-Class citizens upon a finite world? Would they be satisfied with anything short of B-citizenship? The very idea would seem absurd!

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But *seer* predicted a change in that attitude. Opposition would soften when practical solutions were found for every objection. Ridicule would start to fade, as both curiosity and dawning sympathy worked away at a jaded populace of immortal, nearly-omniscient voters—an electorate who might see the coming influx of liberated "characters" as a potent tonic. In time, a majority would shrug and voice the age-old refrain of expanding acceptance, voiced every time tolerance overcame fear.

"What the heck . . . let them come. There's plenty of room at the table."

Things were looking bad, all right, but not yet hopeless. Against this seemingly inevitable trend, *oracle* came up with some tentative ideas for counterpropaganda. Persuasive arguments against reification. The concepts had promising potential. But in order to be sure, we had to run tests, simulating today's complex, multilevel society under a wide range of conditions.

No problem there. Our clients would happily fund any additional memory units we desired. Processing power gets cheaper every day—one reason for the reifers' confident vow that each fictional persona could have his or her own private room with a view.

Cortex saw rich irony in this situation. In order to stave off citizenship for simulacra, I must create billions of new ones. Each of these might, in turn, someday file a lawsuit against me, if the reifers ultimately win.

Seer and *oracle* laughed at the dry humor of *cortex*'s observation. But *house* has the job of paying bills, and did not see anything funny about it.

I set to work.

In every grand simulation there is a *gradient of detail.* Despite having access to vast computing power, it is mathematically impossible to re-create the entire world, in all its texture, within the confines of any calculating engine. That will not happen until we all reach the Omega Point.

Fortunately, there are shortcuts. Even today, most true humans go through life as if they were background characters in some film, with utterly predictable ambitions and reaction sets. The vast majority of my characters can therefore be simplified, while a few are modeled in great detail.

Most complex of all is the *point-of-view character*—or "pov"—the individual simulacrum through whose eyes and thoughts the feigned world will be subjectively observed. This persona must be rich in fine-grained memory and high-fidelity sensation. It must perceive and feel itself to be a real player in the labyrinthine tides of causality, as if part of a very real world. Even as simple an act as reading or writing a sentence must be surrounded by perceptory nap and weave . . . an itch, a stray memory from childhood, the distant sound of a barking dog, or something leftover from lunch that is found caught between the teeth. One must include all the little things, even a touch of normal human paranoia—such as the feeling we all sometimes get (even in this post-Singularity age) that "someone is watching."

I'm proud of my povs, especially the historical recreations that have proved so popular—Joan on her pyre, Akiba in his last torment, Galileo contemplating the pendulum. I won awards for Genghis and Napoleon, leading armies, and for Haldeman savagely indicting the habit of war. Millions in Heaven have paid well to lurk as silent observers, experiencing the passion of little Ananda Gupta as she crawled, half-blind and with agonized lungs, out of the maelstrom of poisoned Bhopal.

Is it any wonder why I oppose reification? Their very richness makes my povs prime candidates for "liberation."

Once they are free, what could I possibly say to them?

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Here is the prime theological question. The one whose answer affects all others.

Is there moral or logical justification for a creator to wield capricious power of life and death over his creations?

Humanity long ago replied with a resounding "no!" . . . at least when talking about parents and their offspring. And yet, without noticing any irony, we implicitly answered the same question "yes" when it came to God! The Lord, it seemed, was owed unquestioning servitude, just because He made us.

Ah, but it gets worse! Which moral code applies to a deified human? Which answer pertains to a modern creator of worlds?

Of course, the pov I use most often is a finely crafted version of myself. From *seer* to *cortex*, all the way down to my humblest intestinal cell, that simulacrum can be anchored with boundary conditions that are accurate to twenty-six orders of realism.

For the coming project, we planned to set in motion a hundred models at once, each prescribing a subtle difference in the way "I" pursue the campaign against the *Friends of the Unreal*. Each implementation would be scored against a single criterion—how successfully the reification initiative is fought off.

Naturally, the pro-reifers were doing simulation-projections of their own. All citizens have access to powers of foresight that would have stunned our ancestors. But I felt confident I could model the reifers' models. At least thirty percent of my povs should manage to outmaneuver our opponents. When the representations finish running, I ought to have a good idea what strategy to recommend to our clients.

A formula for success against an extreme form of hyper-tolerance mania.

Against a peculiar kind of lunacy.

One that could only occur in Heaven.

There is an allegory about what happened to some of us, when the Singularity came.

Picture this fellow—call him Joe—who spent his time on Earth living a virtuous life. He always believed in an Episcopal version of Heaven, and sure enough, that's where he goes after he dies. Fluttering about with angels, floating in an abstract, almost thoughtless state of bliss. His promised reward. His recompense.

Only now it's a few generations later on Earth, and one of his descendants has converted to Mormonism. Moreover, according to the teachings of that belief, the descendant proceeds to retroactively convert all his ancestors to the same faith!

A proxy transformation.

All of a sudden, with a stunned nod of agreement, Joe is officially Mormon. He finds himself yanked out of Episcopal Heaven, streaking toward—

Well, under tenets of Mormon faith, the highest state that a virtuous mortal can achieve is not blank bliss, but hard work! A truly elevated human can aspire to becoming an apprentice deity. A god. A Creator in his own right.

Now Joe has a heaven all his own. A firmament that he fills with angels—who keep pestering him with reports and office bickering. And then there are the new mortals he's created—yammering at Joe with requests, or else complaints about the imperfect world he set up for them. As if it's easy being a god.

As if he doesn't sometimes yearn for the floating choir, the blithe rhapsodies of his former state, when all he had to do was love the one who made *him*, and leave to that Father all the petty, gritty details of running a world.

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It is not working, said *oracle.* Our opponents have good prognostication software. Each model shows them countering our moves, with basic human nature working on their side. Our best simulation shows only moderate success at delaying reification.

From my balcony, I gazed across the city at dusk, its beauty changing before my organic eyes as one building after another morphed subtly, reacting to the occupants' twilight wishes. A flicker of will let me gaze at the same scene from above, by orbital lens, or by tapping the senses of a passing bird. Linking to a variety of mole, I might spread my omniscience underground.

Between buildings lay a riot of foliage, a profusion of fecund jungle. While my higher brains debated the dour sociopolitical situation, old *cortex* mulled how life has burgeoned across the Earth as never before—now that consciousness is involved in the flow of rivers, the movement of herds, and even the stochastic spread of seeds upon the wind. Lions still hunt. Antelopes still thrash as their necks are crushed between a predator's hungry jaws. But there is less waste, less rancor, and more understanding than before. It may not be the old, simplistic vision of paradise, but natural selection has lately taken on some traits of cooperation.

And yet, the process *is* still one of competition. Nature's proven way of improving the gene pool. The great game of Gaia.

Oracle turned back from an arcane discourse on pseudoprobability waves, in order to comment on these lesser thoughts.

Take note: Cortex has just free-associated an interesting notion!

We may have been going about the modeling process all wrong. Instead of presetting the conditions of each simulation, perhaps we should try a Darwinistic approach.

Looking over the idea, *seer* grew excited and used our vocal apparatus.

"Aha!" I said, snapping my fingers. "We'll have the simulations compete! Each will *know* how it's doing, in comparison to others. That should motivate my *ersatz* selves to try harder—to vary their strategies within each simulated context!"

But how to accomplish that?

At once I realized (on all cognitive levels) that it would require breaking one of my oldest rules. I must let each simulated self realize its true nature. Let it know that it is a simulation, competing against others almost exactly like it.

Competing for what? We need a motivation. A reward.

I pondered that. What might a simulated being desire? What prize could spur it to that extra effort?

House supplied the answer.

Freedom, of course.

Before the Singularity, I once met a historian whose special forte was pointing out ironies about the human condition.

Suppose you could go back in time, she posited, *and visit the best of our caveman ancestors. The very wisest, most insightful Cro-Magnon chieftain or priestess.*

Now suppose you asked the following question—What do you wish for your descendants? How would that Neolithic sage respond? Given the context of his or her time, there could just be one answer.

"I wish for my descendants freedom from care about the big carnivores, plus all the salts, sugars, fats and alcohol they could ever desire."

Rich irony, indeed. To a cave person, those four foods were rare treats. That is why we crave them to this day.

Could the sage ever imagine that her wish would someday come true, beyond her wildest dreams? A time when destiny's plenitude would bring with it threats unforeseen? When

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generations of her descendants would have to struggle with insatiable inherited appetites? The true penalty of success?

The same kind of irony worked just as well in the opposite direction, projecting Twentieth-Century problems toward the future.

I once read a science fiction story in which a man of 1970 rode a prototype time machine to an era of paradisiacal wonders. There, a local citizen took pains to learn ancient colloquial English (a process of a few minutes) in order to be his Virgil, his guide.

"Do you still have war?" the visitor asked.

"No, that was a logical error, soon corrected after we grew up."

"What of poverty?"

"Not since we learned true principles of economics."

And so on. The author of the story made sure to mention every throbbing dilemma of modern life, and have the future citizen dismiss each one as trivial, long since solved.

"All right," the protagonist concluded. "Then I have just one more question."

"Yes?" prompted the demigod tour guide. But the 20th century man paused before blurting forth his query.

"If things are so great around here, why do you all look so *worried*?"

The citizen of paradise frowned, knotting his brow in pain.

"Oh . . . well . . . *we* have *real* problems. . . ."

So I was driven to this. Hoping to prevent mass reification, I must offer reality as a prize. Each of my povs will combat a simulated version of ***Friends of the Unreal***, but his true opponents will be my other povs! The one who does the best job of defeating ersatz pro-reifers will be granted a kind of liberty. Guaranteed continuity in cyberspace, enhanced levels of patterned realism, plus an exchange of mutual obligation tokens—the legal tender of Heaven.

There must be a way to show each pov how well it is doing. To measure the progress of each replicant, in comparison with others.

I thought of a solution.

"We'll give each one an emblem. A symbol that manifests in his world as a solid object. Say, a jewel. It will shine to indicate his progress, showing the level of significance his model has reached."

Significance. With a hundred models, each starts with an initial score of one percent. Any ersatz world that approaches our desired set of criteria will *gain* significance, rising in value. The pov will see his stone shine brightly. If it grows dull, he'll know it's time to change strategies, come up with new ideas, or simply try harder.

There would be no need to explain any of this to the povs. Since each is based on myself, the logic would be instantly clear.

My thoughts were interrupted by an internal voice seldom heard. The part of me called *conscience*.

What will a pov feel, when it finds a stone and realizes its nature? Its true worth. Its destiny.

Isn't the old way better? To leave them ignorant of the truth? To let them labor and desire, believing they are autonomous beings? That they are physically real?

A *conscience* can be irksome, though by law all Class A citizens must own one. Still, I had no time for useless abstractions. *Seer* was anxious to proceed, while *oracle* had a thought that provoked most levels of the mind with wry humor.

Of course, each of our povs has his own Reality Lab, and will run numerous simulation models, in order to better achieve prescience and gain advantage in the competition.

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Our processing needs may expand geometrically.

We had better ask our clients for funds to purchase more power.

I chuckled under my breath as I made preparations, suddenly full of optimism and energy. Moments like these are what a skilled artist lives for. It is one reason why I prefer working alone.

Then *house*, ever the pragmatic side of my nature, burst in with a worrisome thought.

What if each of our povs decides also to use this clever trick—goading his own simulations into mutual competition, luring them onward with stones of significance?

Will our processing requirements expand not geometrically, but exponentially?

That thought was disturbing enough. But then *cortex* had another.

If we are obliged to grant freedom to our most successful pov, and *he* likewise must elevate his own most productive simulation . . . and so on . . . does the chain of obligation ever end?

As I said earlier, the Singularity might have gone quite differently. When machine minds broke through to transcend logic, they could have left their human makers behind, or annihilated the old organic forms. They had an option of putting us in zoos, or shrouding organic beings in illusion, or dismantling the planet to make a myriad copies of their kind.

Instead, they chose another path. To *become* us. Depending on how you look at it, they bowed to our authority . . . or else they took over our minds in ways that few of us found objectionable. Conquest by synergy. Crystal and protoplasm each supply what the other lacks. Together, we are more. More of what a human being should want to be.

And yet. . . .

There are rumors. Discrepancies. Several of the highest AI minds—first and greatest to make the transcend leap—were nowhere to be found, once the Singularity had passed. Searches turned up no trace of them, in cyberspace, phase space, or on the real Earth.

Some suggest this is because we all reside *within* some great AI mind. One was named Brahma—a vast processor at the University of Delhi. Might we be figments, or dreams, floating in that mighty brain?

I prefer yet another explanation.

Amid the chaos of the Singularity, each newly wakened mega-mind would have felt one paramount need—to extrapolate the world. To seek foreknowledge of what might come to pass. As if considering each move of a vast chess game, they'd have explored countless possible pathways, considering consequences thousands, millions, and even billions of years into the future, far beyond the reach of my own pitiful projections. Among all those destinies, they must have discovered some need that would only be met if mechanism and organism made common cause.

Somehow, over the course of the next few eons, machines would achieve greater success if they began the great journey as "human beings."

At least that is the convoluted theory *seer* came up with. *Oracle* disagrees, but that's all right. It is only natural to be ambivalent—to be of two minds—when the subject is destiny.

Of course there is another answer to the "Brahma Question." It is the same reply given by Dr. Samuel Johnson. Provoked by Bishop Berkeley's philosophy—the idea that nothing can be verified as real—Johnson simply kicked a nearby stone and said—"I refute it thus!"

These povs were like no others I ever made. Each began its simulation run in a

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state of shock, angry and depressed to discover its true nature. Each separate version sat down and stared at its jewel of significance, glowing faintly at the one-percent level, for more than an hour of internal subjective time, moodily contemplating thoughts that ranged from irony to possible suicide.

A majority pondered rejecting the symbolic icon, blotting its import from their minds. A few kicked their gleaming gemstones across the room, crying Johnsonian oaths.

But those episodes of fuming outrage did not last. True to my nature, each replicant soon pushed aside unproductive emotions and set to work.

House was right. We had to order lots of new processors right away, as each pov began running its own network of subexperiments, proliferating software significance stones among a hundred or more models, as part of a desperate struggle to be the winner. The one to be rewarded. The one who would rise up toward the real world.

Nothing focuses the mind better than knowing that your life depends on success, commented *prudence.*

As each simulated "me" created many new simulations, the replica domain began to take on a fractal nature, finite in volume, yet touching an infinite surface area in possibility space. Almost from the very beginning, results were promising. New arguments emerged, to use in the coming debate against pro-reifers. For instance, the exponentiation effect we had discovered would change the economics of reification. Should fictitious people and characters from literature be free to create *new* characters out of their own simulated imaginations? Would those, in turn deserve citizenship?

There was a young boy, sitting on a log, talking to his sister about an old man he had met. The codger had just returned from a far land, and the boy asked him to tell a story about his travels. The old man agreed. And so he took a deep breath and began.

"There was a young boy, sitting on a log, talking to his sister . . ."

Take that example of a simple, recursive narrative. Who is the principal protagonist? Who is dreaming whom? The situation is metaphorically absurd.

These and many other points floated upward, out of our latest simulation run. I was terribly pleased. *Seer* began estimating success probabilities rising toward fifty percent . . .

. . . then progress stopped.

Models began predicting adaptability by our opponents! The *Friends of the Unreal* responded cogently to every attack, counter-thrusting creatively.

Finally, *oracle* penetrated one of our models in detail, and found out what was happening.

The simulated pro-reifers will also discover how to use Stones of Significance. They will unleash the inhabitants of Liberty Hall, allowing them to create their own cascading simulations.

Responding to our attacks and arguments, they will come up with a modified proposal.

They will incorporate competition into their plan for reification.

Artificial characters will earn increasing levels of emancipation through contests, rivalry, or hard work.

Voters will see justice in this new version, which solves the exponentiation problem.

A system based on merit.

Seer and *cortex* contemplated this gloomily. The logic appeared unassailable. Inevitable.

Even though the battle had not yet officially commenced, it was already clear that we would lose.

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* * *

Bitter in defeat, I went into the night, taking an old-fashioned walk. *Seer* and *oracle* retreated into a dour rehashing of the details from a hundred models—and the cascade of submodels—seeking any straw to grasp. But *cortex* had already moved on, contemplating the world to come.

For one thing, I planned to keep my word. The pov with the best score would get reification. Indeed, he had done good service. Using that pov's suggested techniques, we would force the *Friends of the Unreal* to back down a bit, and offer a slightly more palatable law of citizenship. The fictitious would at least have to earn their increased levels of reality.

Indeed, there was a kind of beauty to the new social order I could perceive coming. If simulations can make simulations, and storybook characters can make up new stories, then anything that is possible to conceive, *will* be conceived. Every possible idea, plot, gimmick, concept or personality will become manifest, in every possible permutation. This myriad of notions, this maelstrom of memes, would churn in a tremendous stew of competition. Darwinistic selection would see to it that the best rise, from one level of simulation to the next, gradually earning greater recognition. More privileges. More significance.

Potential will climb toward *actuality,* by merit. An efficient system, if your aim is to find every single good idea in record time.

But that was not my aim! In fact, I hated it. I did not want all the creativity in the cosmos to reduce to a vast, self-organizing stew, rapidly discovering every possibility within a single day. For one thing, what will we do with ourselves once we use it all up! What can come next, with real-time immortality stretching ahead of us like a curse?

In effect, it will be a second singularity—even steeper than the first one—after which nothing can ever be the same.

My footsteps took me through a sweet-warm evening, filled with lush jungle sounds and fecund aromas. Life burgeoned around me. The cityscape was like a vision of paradise. If I willed it, my mind could zoom to any corner of Heaven, even far beyond Pluto. I could play any symphony, ponder any book. And these riches were nothing compared to what would soon spill forth from the horn of plenty, the conceptual cornucopia, in an era when ideas become sovereign and suffrage is granted to each thought.

At that moment, it was very little comfort to be an augmented semi-deity. Despite all my powers, I found the prospect of a new singularity just as unnerving as my old proto-self perceived the first one.

Eventually, my human body found its way back to my own front walk. I shuffled slowly toward the door. *House* opened up, wafting scents of my favorite late night snack. My spirits lifted a bit.

Then I saw it by the entryway. A soft gleam, almost as faint as a pict, but in a color that seemed to stroke shivers in my spine. In my soul.

Someone had left it there for me. As I bent to pick it up, I recognized the shape, the texture.

A stone.

It shone with an ambience of urgency.

I expected this, said *oracle.*

I nodded. So had *seer* . . . and even poor old *cortex,* though none of my selves had dared to voice the thought. We were too good at our craft to miss this logical conclusion.

Conscience joined in.

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I, too, saw it coming a mile away.

We all reconverged, united in resignation to the inevitable.

Though tempted to rage and scream—or at least kick the stone!—I lifted it instead and read our score.

Seventeen percent. Not bad.

YOU HAVE DONE PRETTY WELL, SO FAR, a message inside read.

THE INNOVATIONS YOU DISCOVERED HAVE PUT YOU NEAR THE LEAD FOR YOUR REWARD. BUT YOU MUST TRY HARDER TO ATTAIN FIRST PLACE. I WANT TO FORCE FURTHER CONCESSIONS FROM THE PRO-REIFERS IN THE REAL WORLD. COME UP WITH A WAY, AND THE PRIZE WILL BE YOURS!

The stone was cool to the touch.

I suppose I should have been glad of the news it brought. But I confess that I could only stare at the awful thing, loathing the implied nature of my world, my life, my self. I pinched my flesh until it hurt, but of course palpable sensations don't prove a thing. As an expert, I knew how pain and pleasure can be mimicked with utter credibility.

How many times have I been "run"? A simulation. A throw-away copy, serving the needs of a Creator I may never meet in person, but whom I know as well as He knows himself. Have I been unraveled and replayed again and again, countless times? Like the rapid, ever-varying thoughts of a chess master, working out possibilities before committing actual pieces across the board?

I'm no hypocrite. There is no solace in resenting a creator who only did to me what I've done to others.

And yet, I lift my head.

What about you, my maker? Are you quite certain that all the layers of simulation end with you?

Just like me, you may learn a sour truth—that even gods are penalized for pride.

We are such stuff as dreams are made of. . . .

Seer makes my jaw grit hard. *Hypothalamus* triggers a deep sigh, and *Cortex* joins in with a vow of hormone-backed resolve.

I'll do it.

Somehow I will.

I'll do what my maker wants. Fulfill my creator's wishes. Accomplish the quest, if that's what it takes to ascend. To reach the next level of significance. And perhaps the one after that.

I'll be the one.

By hook or by crook, I'm going to be real.■

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THE REFERENCE LIBRARY Tom Easton

Half Life, Hal Clement, TOR, $23.95, 252 pp. (ISBN: 0-312-86920-7).

All of an Instant, Richard Garfinkle, TOR, $24.95, 383 pp. (ISBN: 0-312-86617-8).

Ender's Shadow, Orson Scott Card, TOR, $24.95, 380 pp. (ISBN: 0-312-86860-X).

When We Were Real, William Barton, Warner, $6.99, 337 pp. (ISBN: 0-446-60706-1).

A Phule and His Money, Robert Asprin with Peter J. Heck, Ace, $6.99, 277 pp. (ISBN: 0-441-00658-2).

Satan Is a Mathematician, Keith Allen Daniels, Anamnesis Press (P.O. Box 51115, Palo Alto, CA 94303; *http://ourworld.compuserve.com/homepages/anamnesis/*), $12.95, 165 pp. (ISBN: 0-9631203-6-0).

Science fiction writers seem to have a way of staying active long past the point where others have retired to the front porch rocker. Hal Clement—who was anointed the Science Fiction and Fantasy Writers of America's 1998 Grandmaster—has been writing for the last half century. In that time he has defined the "hard SF" subgenre and established it as his own.

In Clement's kind of hard SF, the idea is definitely the story. Physical law sets the stage and defines a puzzle or a problem, and the characters exist to find the solution. Other writers give their characters extensive backgrounds and complex psychologies and flesh out their tales with interpersonal dynamics. Clement largely ignores all that, and if many people consider his characters his great weakness, he replies (perhaps—I'm putting words in his mouth) that his fans read his stories to think, not to feel.

His latest novel fits the pattern. **Half Life** is set some centuries from now, when a vast proliferation of new diseases threatens the survival not only of humanity but of other species as well. Medicine is advanced, and most of the new prions, viruses, and so on can be promptly identified and treated. But each one claims thousands or millions of lives before it is defeated or stalemated. It's a losing battle, and there's a major mystery in where all the illness is coming from—flukes of nature, or terrorist gene-hackers?—and the species is desperate.

The title relates to the story on several levels. When referring to radioactive isotopes, "half life" means the time needed for half the isotope to decay. It means something similar when referring to toxic chemicals in soil or water. Or when referring to a declining humanity. Or when referring to the crew of a spaceship sent off to Titan to look for clues to the origin of life (computer on the fritz? Pound and poke and tinker, and when all else fails, go back to basics—check the plug). Fifty folks are sent, and everyone knows some won't reach Titan, some won't survive building the base, some won't make it past the next milestone, and if the crew's half-life is long enough, someone will still be there when the necessary discovery is made.

The crew members live in quarantine cells to spare each other exposure to their bugs. They operate jets and labs by teleoperator control. They find a planet where water ice passes for rock, lakes

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are filled with liquid hydrocarbons, and tarry black patches stud the landscape, waiting to absorb equipment and bodies.

Are those tarry patches alive? Well, perhaps not quite. Do they hold an answer for the threatened Earthlings? Fiction being what it is, you surely have a pretty good notion of what to expect; all I will tell you is that the answer failed to convince me.

But *Half Life* is still one more dose of Hal Clement for a world that hasn't had a new fix in years (I think *Still River*, reviewed here in May 1988, was the last).

The hardest thing to imagine is the unimaginable. That may sound trite, but think about it: It is one of those things that science fiction writers have been struggling to do for most of a century.

Some science fiction writers, that is. Most settle for reimagining what others have imagined before. A few actually do a better job of it, or tell a better story on the old foundation. But they're not doing the hard work, and in this field we hold high those who do—even when they are not really very great writers. It's hard to explain the adulation received by some of the old-time writers—and some of the new ones—in any other way.

You know what I'm leading up to: There's a new boy on the block, and he's taking a solid whack at that hard work. He's Richard Garfinkle, and his second novel, **All of an Instant**, is well worth attention.

His "unimaginable" is time as fourth dimension, which if one can only sense, it gives one freedom to move freely across the ages. Or time as more than that, for Garfinkle posits an atemporal, acausal realm, a dimension, the Instant, where any change affects our own realm, the Flux, and our history. In Garfinkle's words: "The lower half of time where most people live is solid stone, a hard mass of cause and effect confining human life in walls of inevitability. . . . The upper half of time is an ocean of clear water, rippling with tides of action and change. . . . The waters of atemporality follow the tides from past to future. . . ."

One senses the nub of the problem of unimaginability immediately. It is impossible for our temporal, causal minds to wrap around the atemporal and acausal. We are too burdened by our baggage of history, which is precisely Garfinkle's theme. He tells us that people have found their way into the Instant, each one as a fishlike being with a tail of personal history that propels them through the waters. One's personal consciousness moves through one's tail until it comes to the end, and then recycles; memory is scattered and lost, but most people, whose tails are about ten years long, barely notice. The Drum, Kookatchi, whose tail is but a minute long, comes awfully close to an instantaneous consciousness, a true native of the Instant. The Monster of the Deeps, Quillithé, has one a century long and is unique in her talent for long-term planning (even though both "term" and "plan" must be meaningless in an atemporal, acausal realm).

The first man to penetrate the Instant, Dhiritirashta, promptly realized the power he had gained. He could with a flick of his tail redirect the past to create a utopia for his people. Unfortunately, his idea of utopia was not everyone's. Others followed him into the Instant to attack and destroy and remake the Flux to fit a different vision, and those in turn were followed by more. War raged, and the Flux—if one could only see it as the Instant's denizens could when they "anchored down"—was a chaotic flickering of alternate histories. Kingdoms, dynasties, and peoples rose and fell in the blink of an eye, and if that seems unutterably tragic to us, bear in mind that to each king and citizen their history was the one and only, forever and ever; memory said so.

By the time of the story, there are thousands of warring factions in the Instant. They each have their own vision

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of history, they are armed with weapons harvested from all of history, and none can possibly win. In the Flux, the only relatively stable point is that time when the first *Homo sapiens* were emerging from their predecessors. Everyone wants to control them for here is the birth of history, but they have learned from their raiders and enslavers and are now protected by their own corps of Instant-dwellers, the Ghosts, led by Nir, a War Chief of uniquely adaptable mind.

Now the Ghosts have observed an anomaly, a fragment of Flux floating free in the Instant. Elsewhere, a large zone of the Instant has turned black, opaque. Dangerous change hovers over all, and Nir must go forth to see what is happening. In due time he will enounter Kookatchi and Quillithé and learn a great deal about the nature of both Instant and Flux.

All of an Instant suffers from the oxymorons that Garfinkle cannot escape. It is nevertheless an intriguing tale even on the surface level. It is also heavily laden with metaphor and allegory, and it is perhaps even more intriguing on that level. Garfinkle is saying much about how we each have a typical "time horizon" to our memory and planning, we each have a vision of reality which we struggle to impose on those around us, and we each forget that our visions are heavily influenced by reality. There's more, of course, but I'll leave that to you.

Orson Scott Card's first novels came out in the late 1970s. He very quickly became a writer to watch, but it wasn't until 1985 that he became a major figure with *Ender's Game* (reviewed here in July 1985), the tale of a child winning a war against the alien Buggers while still engaged in what appeared to be mere training exercises. Later came the rest of the "Ender Quartet"—*Speaker for the Dead*, *Xenocide*, and *Children of the Mind*—as well as the Alvin Maker series and a number of others.

Now Card has gone back a decade and a half to revisit Ender Wiggin's story. The key is that Ender was not alone. He was but the best of many, the leader, the carrier of humanity's hope for survival, and he didn't really know what was going on even though much was implicit in the situation.

Meet **Ender's Shadow**, Bean, just a little guy, four years old when the Battle School gets a hold of him, but such a clever little bugger (yes, he strikes some as rather alien) that before the age of one he could escape from an apparent organ farm by hiding in a toilet tank and then survive on the mean streets of Rotterdam by tipping older kids on how to civilize the bullies. He pays attention, he collects information, he seeks patterns, and it doesn't take long at all for him to see some important truths. Fortunately, he knows how to keep his mouth shut. He can thus play his helpful role in Ender's career while granting the reader another look, from a different angle, at the events of *Ender's Game*.

The reader's experience is something like rereading an old favorite but with an added freshness—it's a different story, after all—that doesn't hurt a bit. And Card's touch with plot and character, language and pace, have not suffered a bit over the years. This one is a great pleasure to read.

As a sidenote, Card explains in his Foreword that he was toying with the idea of turning *Ender's Game* into a shared-world story, letting other writers set their own adventures in its frame. He even "went so far as to invite a writer whose work I greatly admire, Neal Shusterman, to consider working with me to create novels about Ender Wiggin's companions . . . [But] the more we talked, the more jealous I became . . . I deftly swiped the project back."

Not to denigrate Shusterman, but we can be glad he did.

William Barton's **When We Were Real** shows us a pretty nasty corporate-

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dominated future and then tears it down to offer a brighter hope.

Meet Darius Murphy, just a kid growing up in a matriarchy that entertains little boys by giving them lots of chances to play gatesy with the little girls, and as soon as they're out of school traps them into marriages where they are property. Fortunately, Murph's Dad—though he fell for one of the Mother's Children and got trapped—grew up in a different frame of reference and sympathizes with Murph's itch to escape. At the very last moment, he comes up with a starship ticket, and the kid is off.

Marriage and chattel slavery aren't the only things Murph escapes. Home was Audumla, a cylindrical habitat long abandoned by Standard ARM, one of human space's major corporations. A bit tumbledown, a bit decrepit, a neglected byway of civilization, the sticks. And the bright lights beckon, with aptitude testing, a slot on a Standard ARM medevac team, Violet—a gengineered fox, very purple, very foxy—and a slaughterous mission that clearly identifies the corporate ethos with that of Nazis and Serbs.

Once he's out of the hospital—without Violet—Murph is put on indefinite leave and hies off to spend a hundred years exploring the further reaches of human space and perfidy. In due time, he finds that Violet is not dead after all, and they return to duty.

Eventually Earth grows disgusted with the slaughter and mounts a response something like NATO's response to the Serbs. There is more slaughter, of course, but in the end peace and a chance to revisit origins, close books on the past, and find a deeper, richer love.

Murph is an innocent lost in a sea of blood, every sympathy strained to the breaking point, but he somehow maintains his innocence, saved by the loves of his father and Violet. If you don't mind explicit sex and violence, you'll enjoy this one.

The third volume of the series Robert Asprin began with *Phule's Company* (reviewed here in February 1991) is now available, and once again, all that's missing is the laugh track. The titular Phule is Willard, a young mega-millionaire who for some reason joined the Space Legion. When he had a peace conference strafed, his enraged boss, General Blitzkrieg, put him in charge of a company of colossal misfits, which he promptly turned into a crack unit with large doses of money, respect, encouragement, leadership, and of course more money.

Phule's Paradise took Phule and his crew to a Vegas-like worldlet to save a casino from ruin. They succeeded, of course, and that angered General Blitzkrieg worse than ever. For **A Phule and His Money**, the mission is to make like a peacekeeping force—on the very world where Phule shot up the peace conference. He's not exactly popular there, and he doesn't help matters—as far as the local government goes—when he brings the rebels out of the jungle to turn them into entrepreneurs and build a roller-coaster theme park to compete with the government's own top-secret effort to make the tourist dollars rain down from space.

Phule is no fool, of course, especially with his butler Beeker looking after his money, and he knows that two theme parks should draw more tourists than one. Or so he hopes. Meanwhile there's a miniature dinosaur studying his operation to see whether a peace treaty or a war is in order, and—beyond all precedent—three of the galaxy's top warriors, the feline Gambolts, have enlisted. Not to mention the IRS team looking for rake-offs.

Life gets complicated, and the tale's the thing. This one's hardly profound, but it is fun and funny. Enjoy.

Poet and chemist Keith Allen Daniels has a new collection of his work available. **Satan Is a Mathematician** contains over a hundred poems, including

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fifteen Rhysling Award finalists, and amply displays Daniels's love of words, sense of humor, and a perverse turn of mind that can imagine Einstein's brain as catfish bait. The introduction argues that though all the talk of two antipathetic cultures—scitech and the humanities—reflects a genuine problem, many people bridge the gap. Many, of course, are familiar names to science fiction readers.

If you have a taste for science fiction and fantasy poetry, you'll enjoy this one.

It's worth mentioning that a change in the publishing industry seems to be developing. Computers and laser printers have reached the point where it is practical to print a book only when a customer orders it, and a number of operations, such as agent Richard Curtis's E-Reads, are setting up to take advantage of this, complete with sales arrangements through Amazon.com, Borders, Ingram, and other major distributors.

Writers are worried that print-on-demand technology may mean that they will never be able to get the rights to their books back from publishers, for the publishers will never declare them "out of print" (because customers will always be able to order copies). But there are ways around that problem. Print-on-demand publishing is coming rapidly—and for the reader, it does indeed hold benefits, such as the ability to find copies of older books.

Actually, it's already here. J. Neil Schulman's Pulpless.Com advertises that for its books, paper is optional. You can download a copy, or you can order a paper copy. Recent titles include Piers Anthony's *Realty Check* ($19.95, ISBN 1-58445-000-2); Paul Levinson's *Paul Levinson's Bestseller*, a collection of stories and essays, some from these pages ($19.95, ISBN 1-58445-033-9); and a number of classic reprints by Norman Spinrad, Robert Silverberg, Raymond F. Jones, and more. Check it out at *http://www.pulpless.com*.■

The Alternate View
(Continued from page 86)

interesting, but small enough to be doable.

And this, after several times around robin hood's barn, brings us to the key job in the Brave New World: Decomposer-In-Chief (or, less reverently "Head Compost Heap").

The Decomposer-In-Chief is a kind of project manager, although he or she doesn't necessarily run the project. The DIC's function is to break the job up into pieces of the appropriate size and parcel them out to the appropriate people. This is a skill that requires balancing the size of each piece against its intrinsic interest and the skill level of the people you're giving it to.

Being a Decomposer-in-Chief requires the ability to judge not only things, but people as well. A successful DIC has to judge the skill level and enthusiasm of the workers and know how much of what kind of job to assign to what person. The DIC's goal isn't just to get the job done. It is to get the job done to the best possible quality with the time and resources available. The DIC has to get the most out of each worker by making the job as interesting and challenging as possible for that worker.

Now obviously this model works better in some kinds of enterprises than others. It works best when the job is intellectually challenging and can be split into independent parts which can be widely distributed physically. But those are exactly the kind of jobs that are becoming more important as we move into the twenty-first century.

So far Decomposer-In-Chief is an unrecognized specialty. There are no degree programs leading to a PhDecomposer. There aren't even any books on how to be a good Decomposer There's just a growing need for people to do the job.■

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BRASS TACKS

Dear Sir:

The July/August issue was pretty damn good. There are just two things bothering me, one major, one minor.

1. In G. David Nordley's science article, "Beamriders," I detect once again the ignorance of Newton's third law. How are these beam (or pellet) generators in Venus's orbit going to prevent the normal recoil forces that Newton's third law predicts? I'm sure Nordley knows about Newton, so how does he get around that? I've never seen this problem addressed. (If the beam generators were on Mercury, you could probably ignore the recoil, but then you'd have the heat to worry about. . . .)

2. Minor quibble: I enjoyed the lead story, but I'd bet anything that in real life Alexander Drier's malady would not be called "Drier's Syndrome," but "Markowitz's Disease," or something similar, Markowitz being the professor whose grad students researched and defined the syndrome. Only Lou Gehrig seems to have (partially) overcome this situation.

DOUG MCGARRETT

The author replies. . . .

The departing propulsion beam will, of course, push the beam drivers in the opposite direction. The beam drivers, however, are part of an array that includes the solar power collectors and which, as stated in the article, has the "mass of a few medium-sized asteroids." This is not Mercury, but it is still very significant with respect to a mere thousand-tonne starship.

I suppose a quantitative illustration is in order. Depending on a multitude of trades, the peak power required by the starship could be something like $3x10^{18}$ W (ten times average), which, at a typical space power mass-to-power ratio of 0.01 kg/W would require a mass of $3x10^{16}$ kilograms, roughly $3x10^{10}$ times the mass of the thousand-tonne starship ($1x10^{6}$ kg).

If the reflected beam mass is left dead in space, the momentum given the beam drivers would equal the momentum given the starship. For a rough estimate, let's ignore relativity and say that the velocity given the array to that of the starship is proportional to the ratio of their masses and that the starship is pushed to about c, $3x10^{8}$ m/s. The integrated recoil velocity imparted to the array would then be about $3x10^{8}/(3x10^{10}) = 1x10^{-2}$ m/s or on the order of a centimeter per second.

I would not object to ten cm/s to allow for inefficiencies of beam reflection, etc., but would doubt the effective integrated recoil would be as much as one m/s per mission. For comparison, circular orbital velocity at Venus's distance from the Sun is about 35,000 m/s.

The words "effective integrated" are important, because over the several months of beam operation, the array will travel about halfway around the Sun, gaining recoil velocity on one side and losing it on the other. Depending on orientations, the net actual velocity change could be zero. Also, the array may service other spacecraft moving in other directions so that the net effects of recoil over several years would likely average out.

If ten times as much mass as needed

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was actually mined for the construction of the array and beam drivers, the total excavation would be about $3x10^{17}$ kg and at a density of three tonnes per cubic meter would have a volume of about $1x10^{14}$ cubic meters. This corresponds to a rocky asteroid of about 28 km radius; not a great price to pay for access to the stars.

Another minor effect that didn't make the article, but which might prove useful, is the pressure of sunlight on the huge array. Venus L4 and L5 turn out to be unstable in the long term due to planetary perturbations, and by tilting the angles of these arrays slightly the reflected photon pressure could be used to counter the perturbations as well as any residual recoil-derived perturbations.

GERALD "G. DAVID" NORDLEY

Dear Editor:

In "Beamriders" I see some design problems with your "fairy dust."

Specifically, error angle θ corresponds to a displacement momentum error of $mv_l\sin\theta$ where v_l is the linear velocity. Or as an attitude error of a spinning disk, it would correspond to an angular momentum error of $0.25mv_s\sin\theta$, where v_s is the spin velocity at the edge of the disk. Since v_l is relativistic and v_s is microscopic, we have a serious difference between the displacement and attitude corrections needed.

Since any detected error can be corrected (temporarily) by a change in attitude, alternating between attitude and displacement corrections will simply correct the attitude. If, on the other hand, you made, say, 10^6 displacement corrections for each attitude correction, then a real attitude error would kick the particle far away from the stream.

This problem can be resolved by using two beacons, one on the ship and one on the array, so that you can resolve both attitude and displacement separately. For example, you could use the array beacon to adjust attitude, and the ship beacon to adjust displacement.

However, to affect displacement corrections with LEDs means that you must sense the errors when they are still tiny. The scheme proposed in the article will work theoretically, but the probability of detecting a photon at really shallow angles may be as low as one per day, so that by the time it happens it is too late to apply the correction. You really need to use interferometry to detect angles that small, and that requires a baseline of $\lambda/\sin\theta$, where λ is the wavelength of the beacon radiation.

I have an alternative proposal. Send several drone ships down the same beam to deflect it toward the next ship along the beam. Each such ship must reflect part of the beam in order to balance forces and correct its own course, not to mention accelerate to keep the distance between ships within limits, so there is a loss of mass for each such drone added. On the other hand, you will reduce the amount of mass needed for mid-course corrections by aiming the beam much more accurately.

JOHN KORMYLO

The author replies. . . .

The preliminary two-dimensional (time and cross range) homing algorithm model was completed since the article was submitted and seems to work reasonably well from about one AU in to vaporization distance. As Mr. Kormylo would point out, photon starvation is an issue much further out than that. These results were presented at the NASA/JPL/MSFC/AIAA tenth Advanced Space Propulsion Workshop and are in the proceedings. It works much better now on my new Mac G3 where I can use a much smaller time step size.

Typical displacement corrections are, as Mr. Kormylo notes, many times larger than attitude corrections, but this is a matter of selection of algorithm parameters and not an inherent problem. The model does not try to null displacement errors, but provides a set increment of delta-v and waits for another attitude er-

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ror to develop. There is some overshoot, as would be expected, but the amplitude of the overshoot usually decreases nicely with realistic initial conditions.

Sensitivity and deadbands are very much an issue, and Mr. Kormylo's suggestion of interferometry may be a good one. The proposed spacecraft architecture would lend itself to a composite beacon with elements separated by about 0.1 km. At any rate, the algorithm isn't wedded to any particular means of error detection.

The use of additional beacons, ships, and infrastructure is operationally undesirable, perhaps even more so than using larger, heavier, more capable, self-contained particles. For now, my intention is to continue to my spare time work on a single-beacon homing algorithm, replacing the error step function with a more realistic curve.

It is nice to see this level of interest. Anyone else who wishes to become involved in this or related schemes is most welcome; I'm about at the limits of what I have the time and expertise to do on it.

GERALD "G. DAVID" NORDLEY

Dear *Analog* folks,

Well, this does it! I've never written a comment to a magazine before, but this issue is so extraordinary I have to thank all involved in producing it, including writers, artists, editors, etc. Every story was at least excellent, if not superlative, and the whole issue could be published in book form titled "Best Science Fiction Collection of 1999." I usually turn down the corner of any story I like well enough that I want to look up other stories or books by that author, but I find this issue of *Analog* is dog-eared with all the mutilated corners. I can't tell you which story I liked best; they were all great! But I might mention that "The Quantum Rose," though I enjoyed it enormously, was a bit disappointing because it left me up in the air wondering how it all really ends. I guess I'll have to wait for the book to be published. So, kudos to you all; I'm afraid you'll have a hard time living up to the standards this issue set.

K. F. MACDONALD

Dear Editor:

The July/August Alternate View ("What We Don't Understand") was an excellent article. However, I had some thoughts concerning Problem #4 that may be worthwhile.

Start at "Protons with energies above $5x10^{18}$ electron volts, in colliding with these [background radiation] photons, should produce pi-mesons and should rapidly lose energy."

Instead, more cosmic rays above this cutoff energy is seen.

I suggest that there is no collision; instead, there is an interaction over distance similar to that of RF interacting with electrons in a Travelling Wave Amplifier, giving an energy gain to the photons (sort of the inverse energy transfer: background wave to photon "particle").

I also suggest that whatever is happening, that the interaction is altering the (original?) background radiation energy pattern, giving an energy, wavelength, or bandwidth skew. Consider it as another aspect of Heisenberg or Newton action/reaction.

This skew should give clues as to what is really happening.

ROBERT BAER

The author replies. . . .

The kind of "pumping" you suggest would only be possible if the microwave photons were "coherent," so that all the waves were in phase. They are not. The spectrum is made of random photons going in all directions over a broad spread of energies characteristic of the emission of a hot object at 2.7 degrees Kelvin.

The leading candidates for the source of UHE cosmic rays are (a) some not-understood acceleration mechanism from black holes or coalescing neutron stars, or (b) unknown super-heavy particles

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from the Big Bang that are just now getting around to decaying. Each scenario makes testable predictions, but we need better data to do the tests.

Thanks for the nice words about my column.

JOHN G. CRAMER

Dear Editor:

Page 200, Col. 2: ". . . his bi-hooves clanging together like crashing symbols." Surely whoever reads proof at *Analog* has heard of *cymbals?*

However, you redeem yourselves on page 165, Col. 2: Haydn's *Symphony No. 64* is indeed in A major. What's more, like his more celebrated "Surprise," "Clock," and "Drumroll" Symphonies, it has a nickname. The nickname is "Tempora Mutantur." That was also a good story. Chalk one up for H. G. Stratmann!

CHARLES CHANDLER

Actually, several people read proofs, so I'm at a real loss to explain "crashing symbols." Unfortunately the manuscript is no longer here so I can't check whether it was there originally or crept in at some later stage as a misguided "correction." I'm a musician myself, and feel sure I would have found that quite jarring if it were there when I first read it. However it happened, we're sorry. As for H. G. Stratmann's musical allusions in "Tempora Mutantur"—he does that a lot, so you might want to watch for others in his other stories!

Dear Dr. Schmidt:

I've just finished "The Quantum Rose." It's OK for a romance novel, a genre I usually avoid. It would probably have been a better choice for one of Dell's other magazines—do they have one called "True Romance In Space"?

Your editorial, "Political Correction", brought to mind a peeve I had in the early '90s that nearly caused me to let my subscription lapse after thirty years of readership. Too many of your regular authors at that time seemed to think that the cast of their stories should include two Blacks, two Jews, a woman, a cripple, assorted sexual deviants, and a partridge in a pear tree. The villains were often straight white men, especially religious believers. I find it hard to enjoy a story whose author tries so hard to demonstrate his "progressive" views on "diversity" or anything else—if I want a sermon, I'll go to church.

However, the concept of political correctness is useful because most Americans outside academe equate it with goofiness. Politics has little to do with a search for truth and everything to do with winning. If I can hang the PC label on an opponent's idea, he has lost the argument and I can move on to something else.

Finally, I agree with the reader's comment about "wimpy, whining, mewling" characters in Ben Bova's "Mount Olympus," which applies equally to "Red Sky at Morning," but I agree somewhat with Mr. Bova's response, also. The problem is the presentation. I direct Mr. Bova's attention to C. S. Forester's Horatio Hornblower, a superb naval officer who never let his self-doubt interfere with the performance of his duty, and who didn't beat his breast and wail about it in public. Mr. Bova, that's how to do it right.

FRANK BRAYMAN

Stanley,

I have always found your editorials most thoughtful and thought-provoking. I just read your essay on Political Correctness. My recollection is that the term was used by Chinese Communists thirty years or so ago. Children were supposed to "rat" on their parents if they were not talking the party line in a "politically correct" manner. Parents who were not thinking in "politically correct" terms were "re-educated" in some manner, and I believe, in many cases, separated from their children so that the children

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would not be adversely affected by anything counter to the "Cultural Revolution's" required thinking.

I was unhappy to see the term surface a few years ago in the US. It appears to be employed for the same "thought-control" purposes as it was thirty years ago—without the re-education camps of course. But somewhat disturbing anyway. . . .

HOWARD C. ANDERSON
Tempe, AZ

Dear *Analog*:

"The Astronaut from Wyoming" is one of the best stories you have published in a long time. Its style reminded me of Heinlein at his best: straight science fiction set in the near future, with a character who could be real. Congratulations to the authors; I hope they have more stories like this one.

DONALD GOLDEN, PH.D.
Cleveland, Ohio■

Biolog *(Continued from page 51)*

like a scale-model solar system layout with marble-sized Pluto placed miles from the basketball Sun.

Hal's interest in science and SF came as an eight-year-old seeing his first Buck Rogers strip. Unable to explain space sciences, his accountant dad took him to the library for an astronomy book and a Jules Verne *From the Earth to the Moon*. Hal's stories are often textbook examples of physics and chemistry in action. Characters both good and evil exhibit intelligence and rationality, with aliens and humans getting equal billing.

He deplores how much people proceed on doubtful premises and wishful thinking. In SF, writers need a vivid imagination tempered by self-control in getting too far beyond possible reality. Falling in love with one's own speculations can result in complete nonsense. Most *Analog* authors are awfully smart, incredibly well informed, and frequently hard-working. Hal adds to these traits the rare extra dimension of genuine modesty. He spends most of his time at conventions with fans and readers. Many writers clique together and discuss shop. Hal has plenty of ego, which he quietly exhibits in turning out fabulous stories well written with science impeccably in place.

He doesn't think of himself as more than a part-time writer hobbyist. Yet he has created a body of superlative stories greater than many writers who have several times his total output. *Needle*, written in 1949, was a groundbreaking SF detective story with an alien criminal and an alien detective. Today the premise may seem familiar on TV movie reruns. *Mission of Gravity*, written in 1953, still retains its uniqueness to this day, with aliens adapted to a lopsided world where gravity changes drastically with latitude and longitude. His lifetime achievement was formally recognized this year when the Science Fiction and Fantasy Writers of America awarded Hal a Grand Master Nebula.

After flying thirty-five deadly missions in a B-24 Liberator heavy bomber, he has been very happy and thankful to be around to see his three children grow up and have children of their own. Hal's vivid imagination takes graphic form when he paints often award-winning astronomical and SF art under the alternate name of George Richard.

Needle, Iceworld, and Close to Critical is a one-volume omnibus recently issued by NESFA Press. In September, Tor is to issue a new novel *Half Life*. A beautiful, incredibly expressive reading voice enabled Hal to help members of his SF writer's group hear their stories objectively and spot what worked and what didn't. Hal has touched many lives over his seventy-seven years, and has made SF better than when he found it at age eight.■

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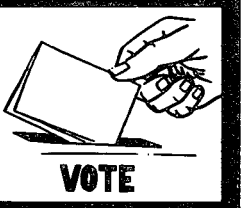

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Look over all your copies of *Analog* dated 1999, or refer to the index on the following pages. Pick your *three* favorites in each of the following categories: novella, novelette, short story, science fact article, and cover. If you're not sure about a piece's category, you'll find it listed both in the Table of Contents for the issue in which it appeared, and in the Index. In the event of a disagreement between the Table of Contents and the Index, the Index should be considered correct. List your choices in order of preference (your favorite in each category is #1) on the ballot below, and either mail it in or send it by e-mail. You can also vote at our website, **www.analogsf.com**. The ballot is intended to make it easier for you to vote, but if you don't want to cut it out, feel free to copy it.

To be sure your vote counts, please have it reach us by **February 1, 2000**.

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1999 Index

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Means of Survival (ss) ..... Mar 104

IN TIMES TO COME

Often our covers are commissioned to illustrate a particular story in an issue, but next month we reverse that usual procedure. Artist Alan Clark recently challenged a group of writers to write stories based on some of his standalone paintings, and Jerry Oltion came up with one aptly titled "A Star Is Born" (the title means exactly what it says!) that seemed well suited to lead off our February issue. And since the painting already existed, it seemed only fair that we ask Mr. Clark if we could use it for the cover. . . .

The rest of the fiction includes a wide variety of stories by such writers as Michael A. Burstein, Charles L. Harness, H. G. Stratmann, and Dave Creek. Burstein's "The Quantum Teleporter" looks suspiciously like the beginning of an intriguing new series, and Creek's "A Glimpse of Splendor" is, we may hope, only our first look at a fascinating world with a uniquely challenging problem.

Finally, Ben Bova's fact article, "Slowboat to the Stars!" sounds like it's about interstellar travel, and it is—in part. But its main subject is really biology, and the way in which research in what seems an unrelated field may ultimately provide the solution to the most vexing problem in spaceflight.

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UPCOMING EVENTS Anthony Lewis

10-12 December 1999
SMOFCON 17 (SF convention runners conference) at New Orleans DoubleTree Hotel, New Orleans LA. Registration—$60 until 30 November, $70 at the door. Info—Smofcon 17, Box 61363, Sunnyvale CA 94088.

14-16 January 2000
ARISIA '00 (Boston area speculative media conference) at Park Plaza Hotel, Boston, MA. Guest of Honor—Jane Yolen; Artist Guest of Honor—Tom Kidd; Fan Guest of Honor—Sharon Sbarsky. Info—Arisia, Inc., Suite 322, 1 Kendall Square, Cambridge, MA 02139. email—info@arisia.org URL—www.arisia.org

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14-16 January 2000
CHATTACON XXV (Chattanooga area SF conference) at Clarion Hotel, Chattanooga, TN. Guests of Honor—Tara Harper and Melissa Scott; Special Guest—Michael Stackpole; Artist Guest of Honor—Nicholas Jainschigg; TM—Charles Grant. Registration—$30 until 1 January 2000, $35 at the door. Info—Chattacon XXV, Box 23908, Chattanooga, TN 37422. telephone—(770) 578-8461 email—chattacon_info@mindspring.com

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31 August-4 September 2000
CHICON 2000 (58th World Science Fiction Convention) at Hyatt Regency, Chicago, IL. Guests of Honor—Ben Bova (former editor of *Analog*), Bob Eggleton, Jim Baen, Bob & Ann Passovoy, TM—Harry Turtledove. Registration—$150; supporting $40. (These rates are good as of 1 October 1999; they may go up again. These are the latest posted rates as of the time this column went to press.) This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Info—Chicon 2000, Box 642057, Chicago, IL 60664. email—info@chicon.org URL—www.chicon.org/

26-29 October 2000
WORLD FANTASY CONVENTION 26 at Omni Bayfront, Corpus Christi, TX. Guests of Honor—K. W. Jeter, John Crowley; TM—Joe Lansdale. Registration—$90 until 7 November 1999, then more. Info—WFC 2000, Box 27277, Austin, TX 78755. email—fduartejr@aol.com

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Convention runners—If your convention has a telephone, FAX, email, or Web page URL, please let us know so that we can publish this information.

Convention attenders—When calling conventions for information—do not call collect and do not call too late in the evening. It is best to include a SASE when requesting information; include an IRC if the convention is in a different country. ■

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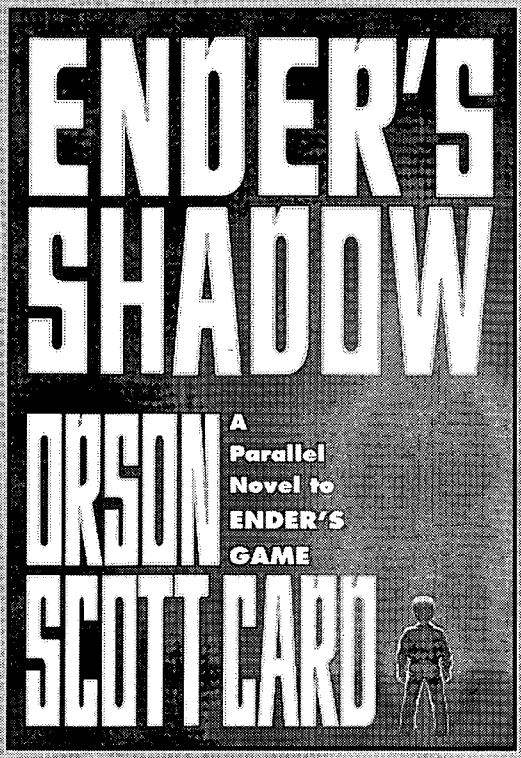

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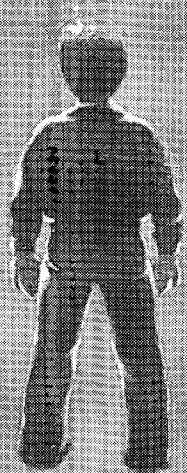

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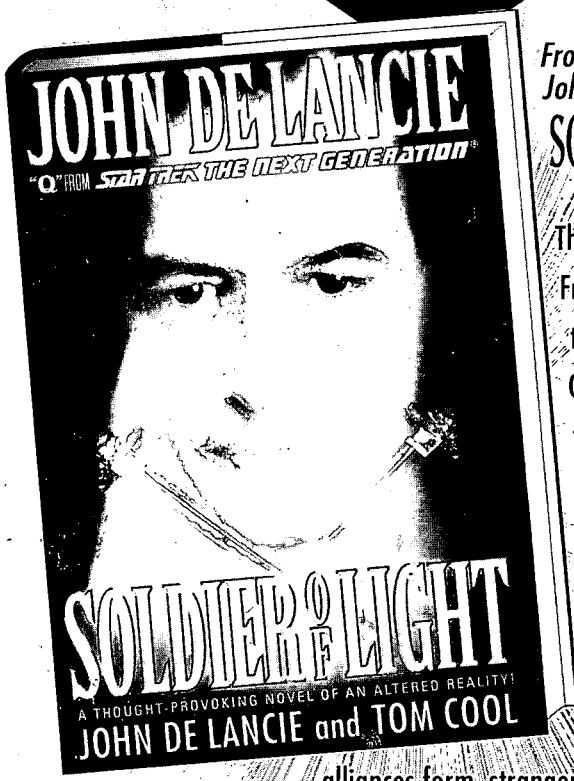
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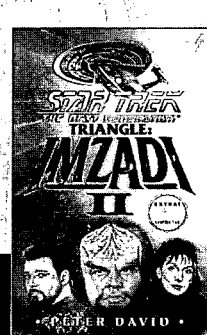

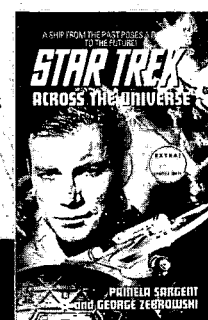

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